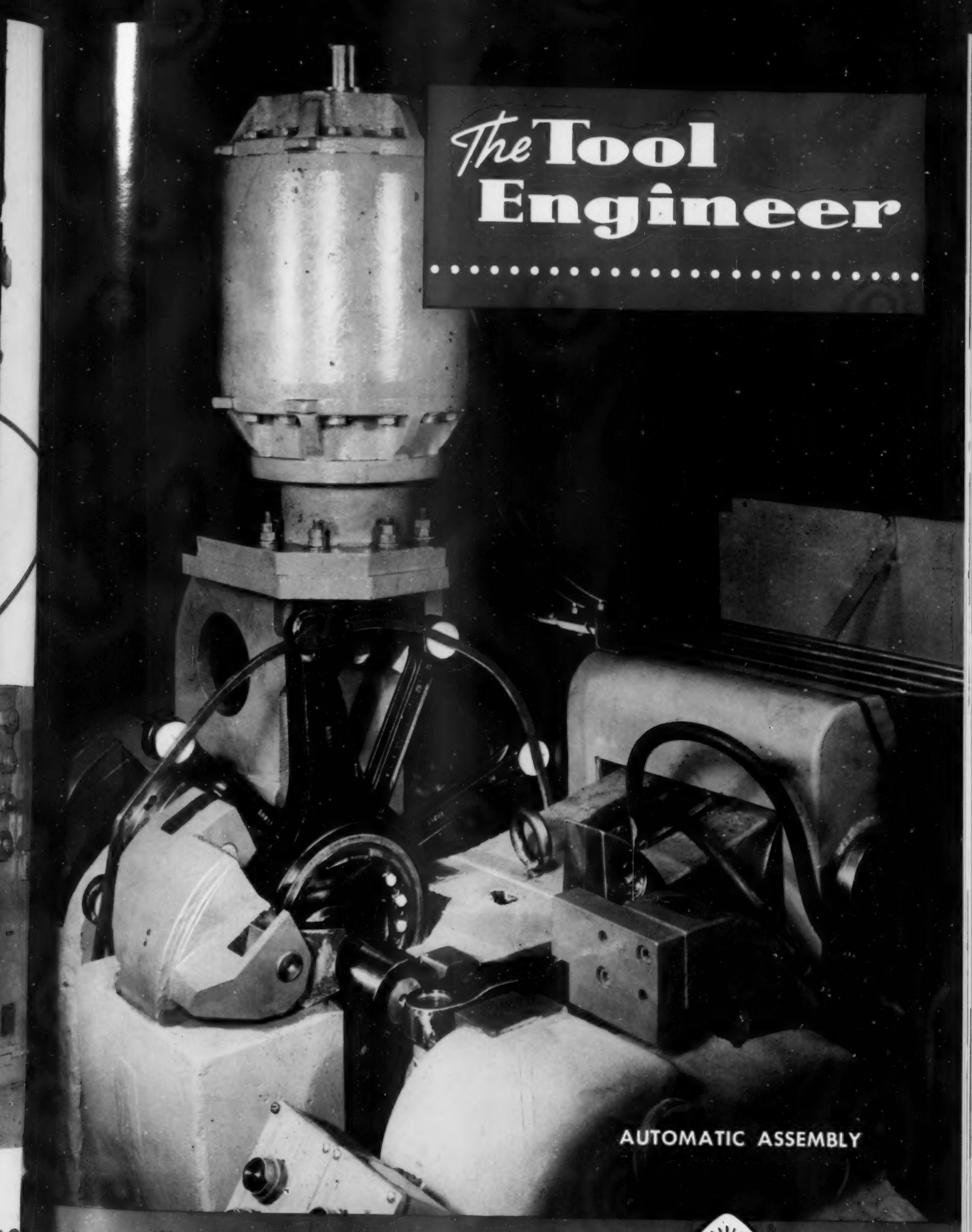


The Tool Engineer

AUTOMATIC ASSEMBLY

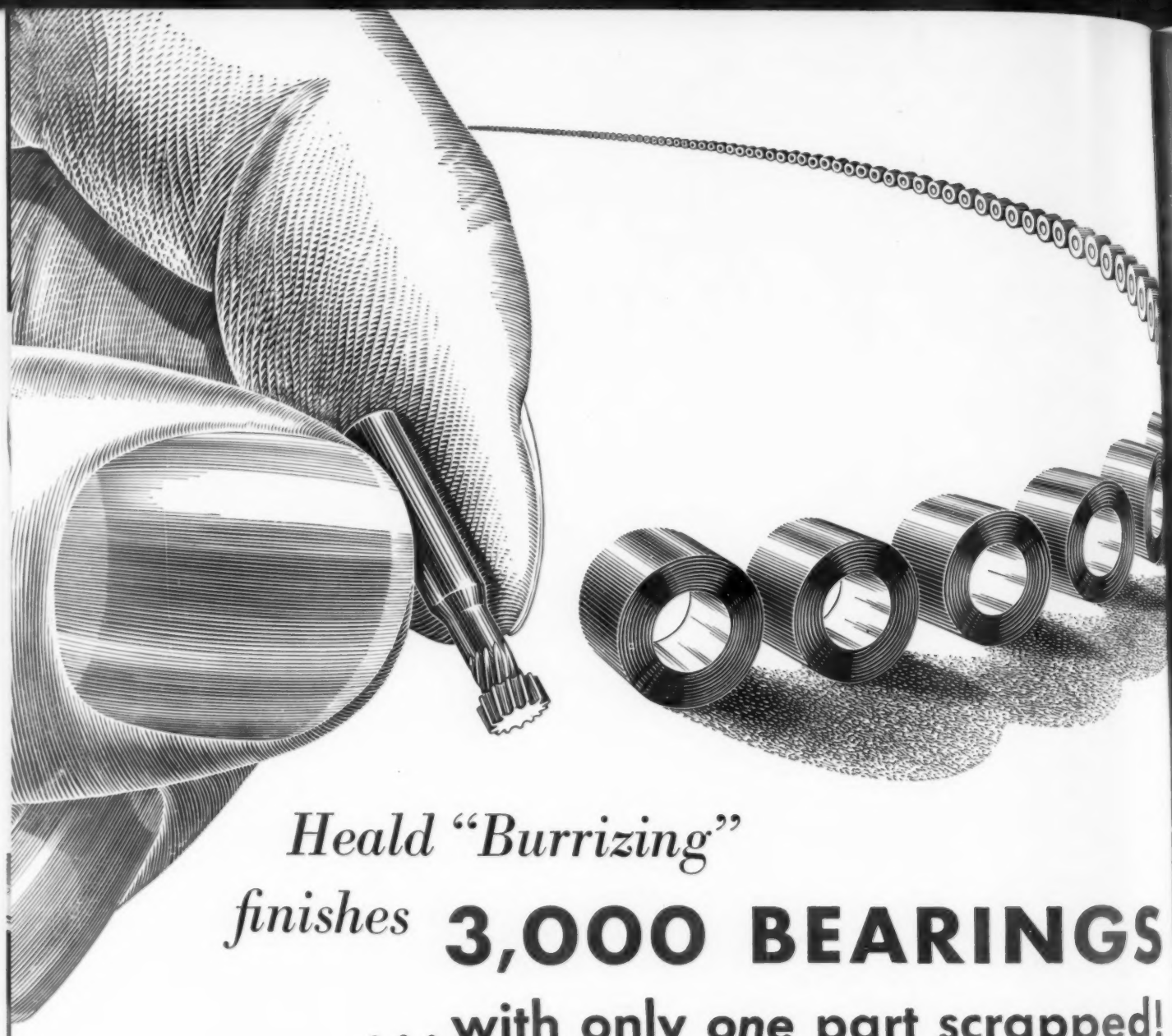
PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

AUGUST, 1953

PLANNING ENGINEERING CONTROL OF TOOL EQUIPMENT PRODUCTION

Cover: Automation applied to the assembly of precision fit parts assures control of quality. Designed by Hau-

The Tool Engineer

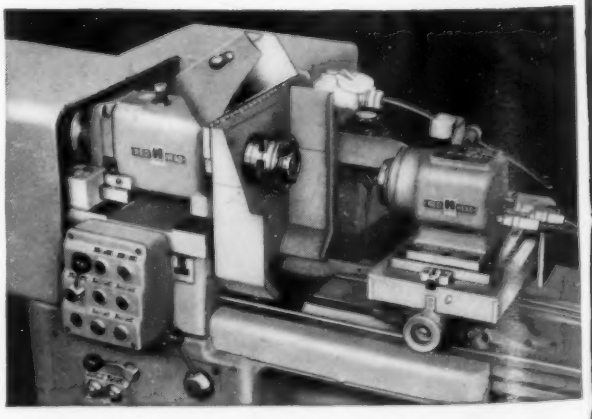


Heald "Burrizing"
finishes 3,000 BEARINGS
. . . with only *one* part scrapped!

The use of a burr instead of a boring tool on a Heald Bore-Matic is somewhat unusual, but when it's practical, interesting things happen. Here's a case in point.

A model 121 Bore-Matic, equipped with a high-frequency grinding wheelhead, uses a ⅛" shank burr for precision finishing the I.D. of miniature bearing races. Size limits of .0002", .000050" for roundness and .0001" for concentricity are easily held. Three thousand parts have been finished in five, seven-hour shifts—with but a *single scrap part!* Burr is dressed intermittently by a diamond hone and customer reports that tool life lasts up to 5,000 pieces!

Remember—when it comes to precision finishing, it pays to come to Heald.



Internal and Rotary
Surface Grinding Machines
and Bore-Matics

HEALD

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

Cover: Automation applied to the assembly of precision fit parts assures control of quality. Designed by Hautau Engineering Co., this machine assembles six components of a radial-engine crankshaft with precision beyond the ability of expert craftsmen. The article beginning on page 37 discusses the interesting operations and control involved.

The Tool Engineer

Volume XXXI, No. 2 **August, 1953**

TECHNICAL ARTICLES

ASTE NEWS

DEPARTMENTS

THE TOOL ENGINEER is regularly indexed in *The Industrial Arts Index.*

AMERICAN SOCIETY OF TOOL ENGINEERS

THE TOOL ENGINEER is published monthly in the interest of the members of the American Society of Tool Engineers. Entered as second-class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription for members, $2.00. Non-members, $6.00. Canada, $6.50; all other countries, $8.00 per year

OFFICE OF PUBLICATION: 239 E. Chicago St., Milwaukee, Wis.
EXECUTIVE AND EDITORIAL OFFICES: 10700 Puritan Ave., Detroit 21, Michigan.

HANDLE ALL YOUR EMULSIFYING CUTTING OIL NEEDS with S.E.C.O. and S.E.C.O. HD "F"

Sunoco Emulsifying Cutting Oil — For general-purpose cutting and grinding. This product is more widely used in metal-working plants than any similar oil. It has high emulsion stability and cooling efficiency, excellent lubricating and rustproofing characteristics. Those features, plus low initial cost, make S.E.C.O. ideal for a wide range of machining, grinding and rolling operations on both ferrous and nonferrous metals.

Sunoco Emulsifying Cutting Oil HD "F" — For heavy duty cutting. Its extreme pressure properties give it a film strength more than twice that of regular emulsifying oils. This high film strength, plus increased "oiliness" characteristics, makes it ideal for machining jobs too tough for regular soluble oils and too hot for straight cutting oils. Emulsions of S.E.C.O. HD "F" are clean smelling and will remain so in service.

For complete data on S.E.C.O. and S.E.C.O. HD "F," call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. TE - 8.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO

PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

Entered as second-class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription for members, $2.00. Non-members, $6.00. Canada, $6.50; all other countries, $8.00 per year

OFFICE OF PUBLICATION: 239 E. Chicago St., Milwaukee, Wis.
EXECUTIVE AND EDITORIAL OFFICES: 10700 Puritan Ave., Detroit 21, Michigan.

THE TOOL ENGINEER
Publication of The American Society of Tool Engineers
10700 Puritan Ave.
Detroit 21, Mich.

The Tool Engineer

That Human Element!

When a manual operation is avoided in a production process, the resulting product is more uniform, production is increased and costs are reduced. Every day, manual operations are being eliminated from processes by progressive tool engineers. The unintentional negative human element of an operator is being replaced by the premeditated positive human element of the engineer.

Although most operations can be automated, depending on the ingenuity and resourcefulness of the engineer, factors of cost, time and quality must be carefully weighed. On small production runs, the additional setup time required for automation might easily absorb the advantages to be gained during the run. Then, unless the control of quality gained through automatic handling and gaging justifies increased costs, the operation would be uneconomical.

Until recently, the positive human element—the tool engineer—has concerned himself only with automating production lines; having a workpiece travel through several operations and end as a finished part without intermediate storage. Now, tool engineers are applying the same principles to the assembly line. They have found that repetitive assembly operations frequently lend themselves to automation with possible savings and improved products.

As an example, the lead article in this issue discusses the features of a machine for assembling six components into a radial engine crankshaft. Although quantities are relatively small, this machine will produce crankshaft assemblies in much less time and consequently at lower cost than has been possible with skilled craftsmen. This automatic assembly machine was developed because the inherent inaccuracies of even the most skilled workmen resulted in several steps including assembly, teardown and reassembly before all parts could be joined in correct relation to each other.

We are apt to be thankful for the human element in most of our experiences, but whenever it is removed from a mechanical operation and supplied by the tool engineer at the planning stage, a potential headache has been avoided.

John W. Greve

EDITOR

STANDARD Gages

The New Size 00 with Centering-Size Discs

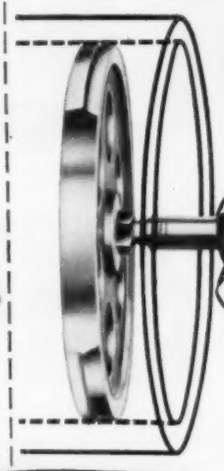
Range ¼″ to ⅜″

Pat. Appl. For

Dial Bore Gages

8 Sizes cover range ¼″ to 12⅛″ (with extensions to 16″)

Standard, Vertical and Pistol-Grip Types



DuBo Plug Gages

Patented

Tells more, more easily, than ordinary plug gages.

Extremely light in weight.

Single End: Sizes over 1.510″
Double End: Sizes under 1.510″

Dial Indicators

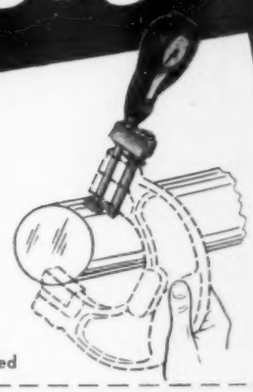
Consistently accurate. Shockproof. A wide range of sizes and graduations, including Long Range, 90 Degree, Long Stem and Decimatic models.

Your Choice of Many Gages

Dializers

An economical, effective means for converting AGD Adjustable Limit Snap Gages (Models A, B or C) to Dial Snap Gages. Easily installed or transferred from one frame to another.

Patented



Dial Snap Gages

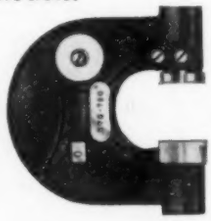
Comparator (shown here with optional stand), Encased and Decimatic Types

Stock sizes cover range 0″ to 8″

Larger sizes available

Adjustable Limit Snap Gages

AGD designs in both regular and midget models.



Also . . .
Master Setting Gages
Comparators
Dial Depth Gages
Dial Pin Gages
Adjustable Limit Length Gages
and Others . . .
Write for New Catalog C

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

HARDINGE ELMIRA, N.Y. Collets for Lathes and Milling Machines

for **ACCURACY**
DURABILITY
ATTRACTIVE PRICE
STOCK DELIVERY

Specify **HARDINGE** *Collets*

A useful reference list for Purchasing and Engineering departments. Helpful ordering information and up-to-date listing of popular style collets for all makes of lathes and millers. Shows major dimensions; maximum capacity for round, square and hexagon; collet adaptations for nose type chucks; stocking locations; how to order and prices.

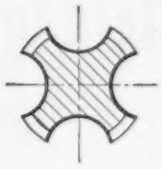
WRITE NOW!

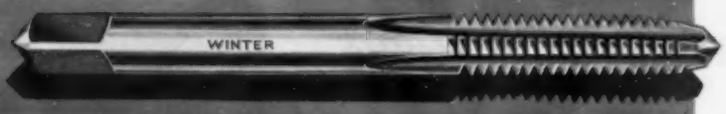
If you do not have a copy of Bulletin No. 50

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

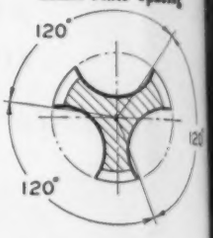
PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

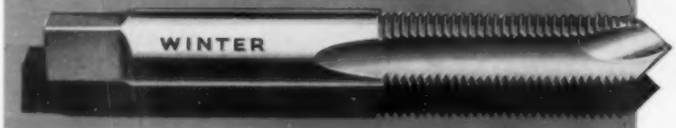
Uniform Flute Contours



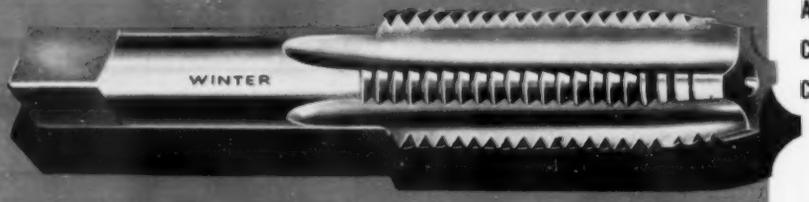


Exact Flute Spacing

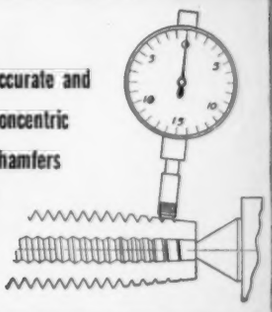




Precision Chip Driver Contours



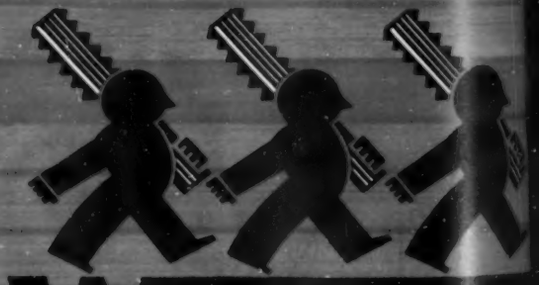
Accurate and Concentric Chamfers



FOR CLOSE-LIMIT HOLES,

You Need These Precisely-Accurate WINTER TAPS with

BALANCED *Action*



WINTER

ALWAYS AT YOUR SERVICE

Your local Industrial Supply Distributor carries a complete stock of WINTER Taps.

WINTER BROTHERS COMPANY

Rochester, Michigan, U. S. A. Distributors in principal cities. Branches in New York, Detroit, Chicago, Dallas, San Francisco

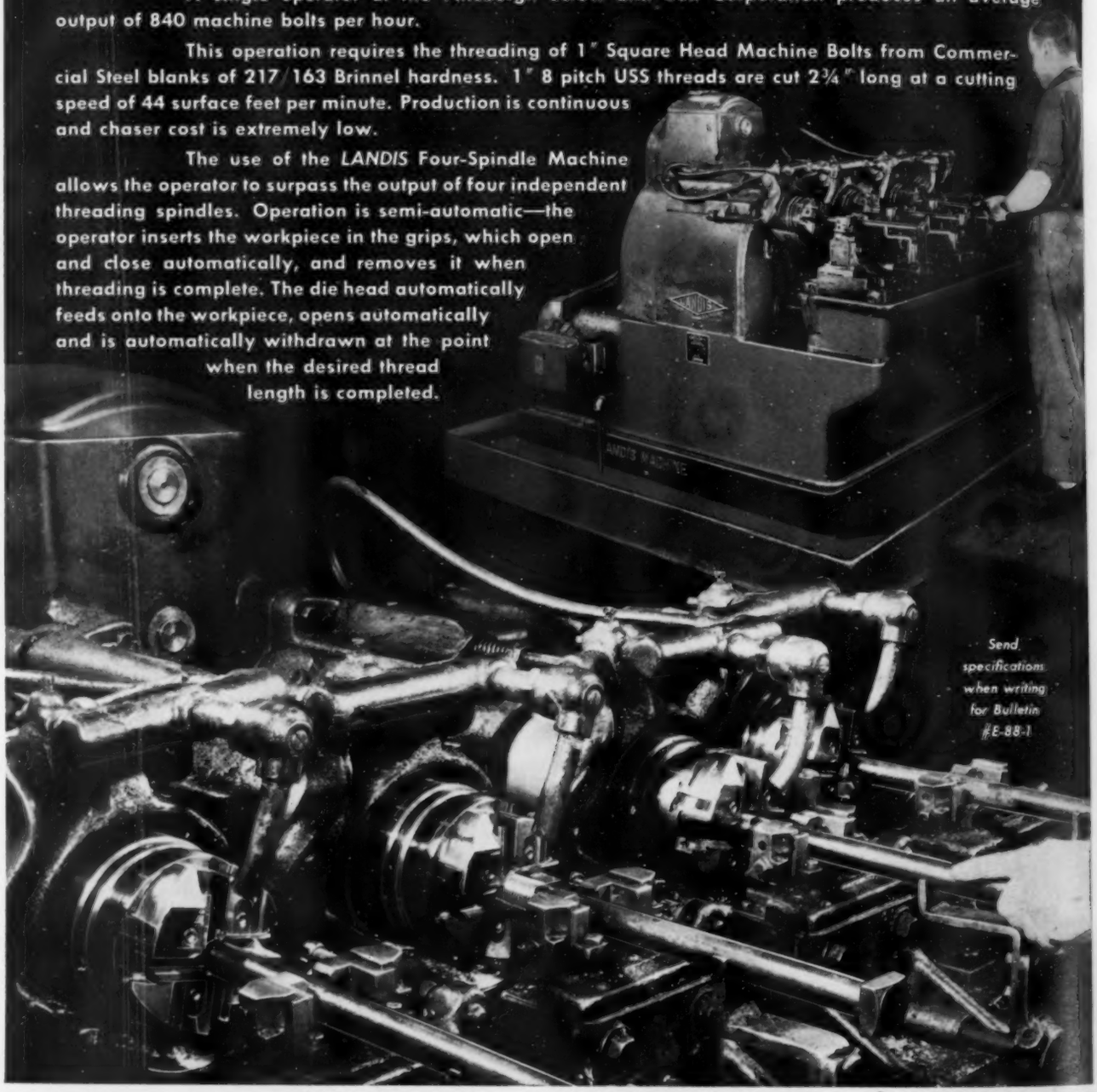
Division of National Twist Drill & Tool Co.

One Machine Bolt Threaded Every 4⅓ Seconds... WITH THE LANDIS 4-SPINDLE SEMI-AUTOMATIC THREADER

A single operator at the Pittsburgh Screw and Bolt Corporation produces an average output of 840 machine bolts per hour.

This operation requires the threading of 1" Square Head Machine Bolts from Commercial Steel blanks of 217/163 Brinnel hardness. 1" 8 pitch USS threads are cut 2¾" long at a cutting speed of 44 surface feet per minute. Production is continuous and chaser cost is extremely low.

The use of the *LANDIS* Four-Spindle Machine allows the operator to surpass the output of four independent threading spindles. Operation is semi-automatic—the operator inserts the workpiece in the grips, which open and close automatically, and removes it when threading is complete. The die head automatically feeds onto the workpiece, opens automatically and is automatically withdrawn at the point when the desired thread length is completed.



Send specifications when writing for Bulletin #E-88-1

THE LANDIS *Machine* CO. 50TH ANNIVERSARY WAYNESBORO PENNSYLVANIA

Do you require CLOSE TOLERANCES

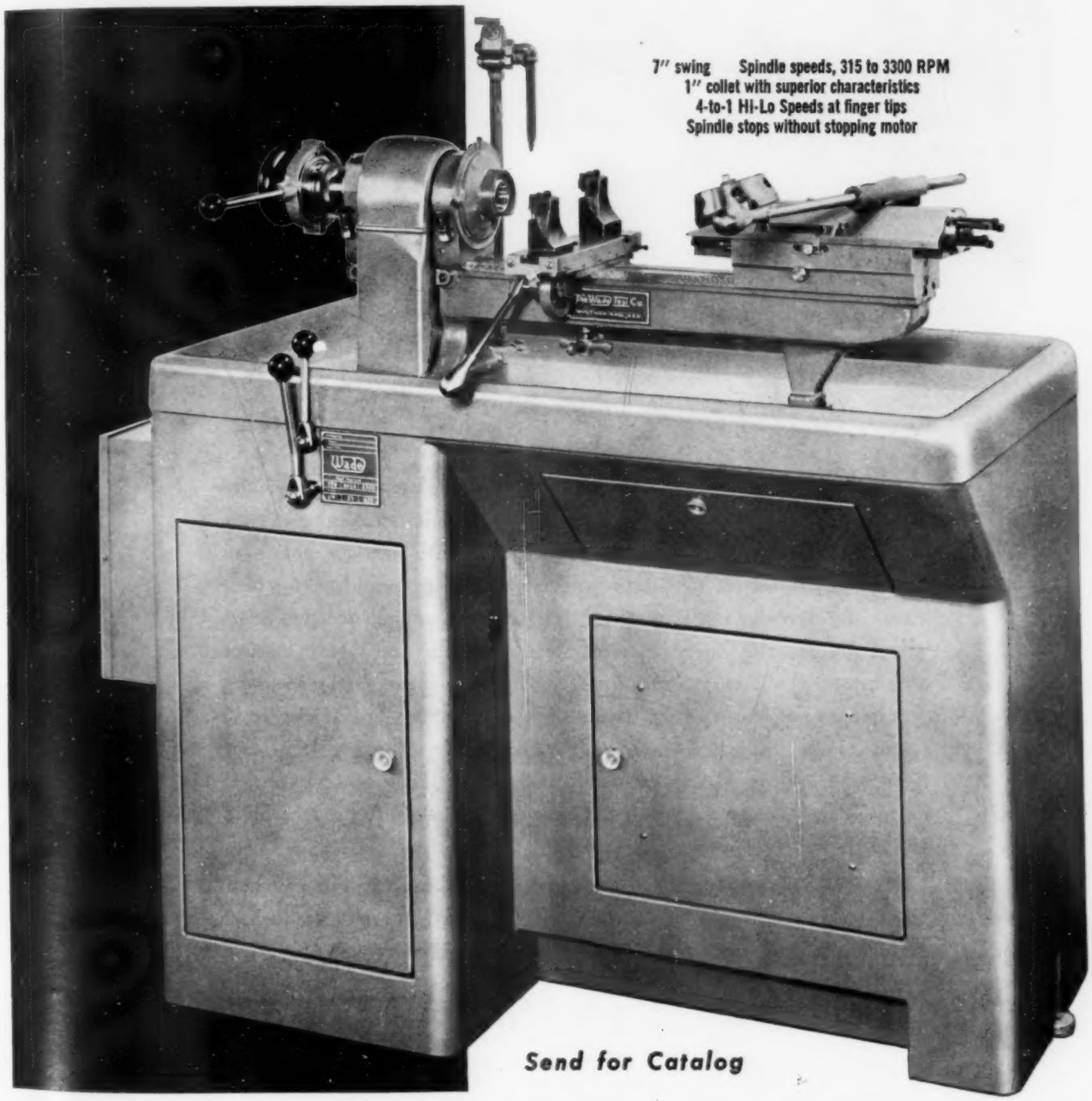
and fast production on your SECOND OPERATION WORK?

You will get it . . . and more . . . with the No. 7 HAND SCREW MACHINE

Wade®

It is especially designed for economical operation on production runs because of these features:

- Cut-away case-hardened steel tool blocks permit the operator to get tools closer to the nose of the spindle to hold closer tolerances.
- Quick-acting collet closer makes easy and speedy chucking; and fast removal of work.
- Wide range of spindle speeds.

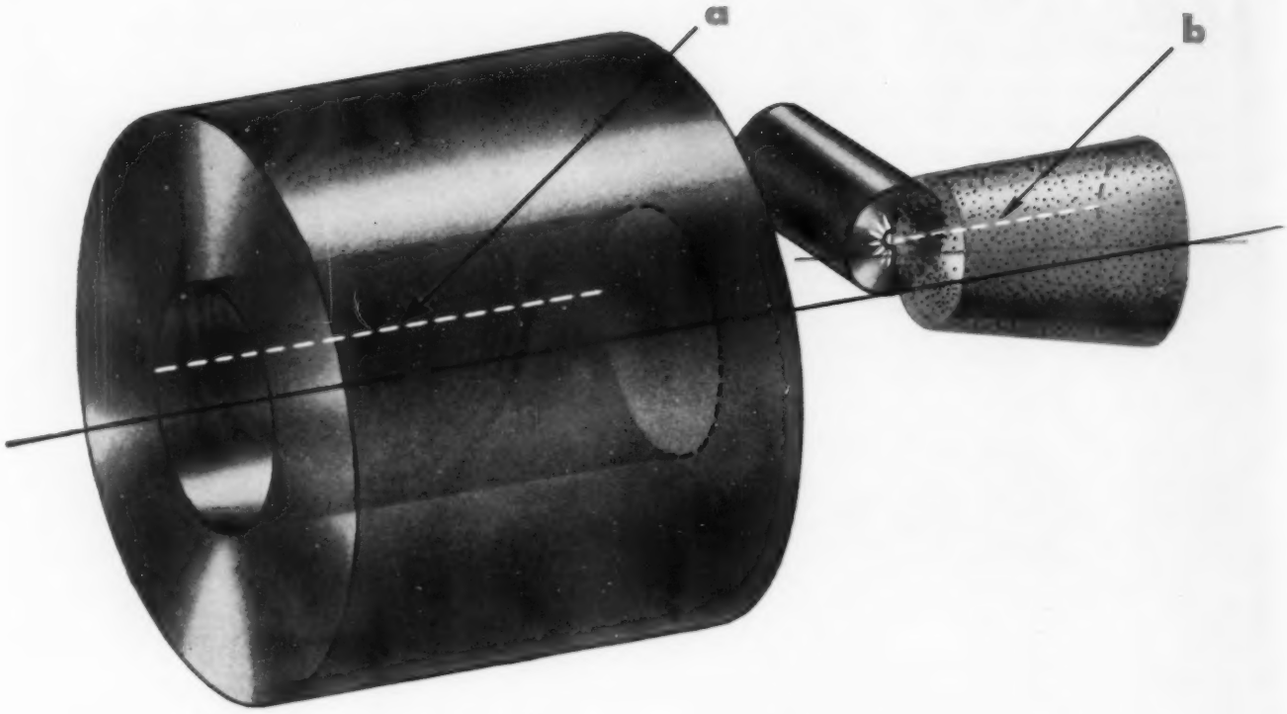


Send for Catalog

THE WADE TOOL CO., 59 River St., Waltham, Mass.

alignment

for better internal grinding

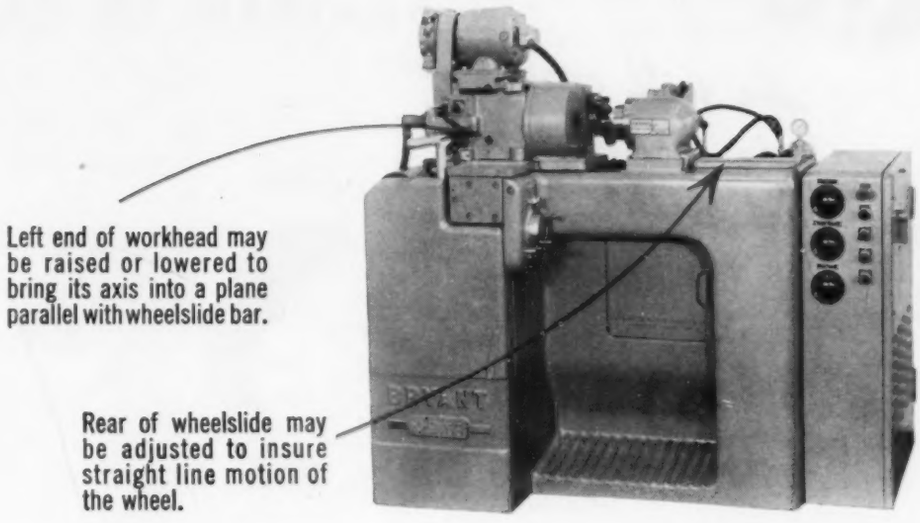


GRINDING a straight hole on an internal grinder is normally done with a straight (cylindrical) wheel. It is sometimes desirable to turn the wheelhead and dress the wheel to a taper in order to use a more rigid projection. However, this setup presents some serious obstacles which cannot be overcome unless they are clearly understood. In order to grind a straight hole the various elements of the machine must be in perfect alignment. The degree of alignment will be determined by the accuracy required on the finished part. A machine may be lined up sufficiently to produce holes within tolerance when grinding with a straight wheel, but if the wheel is turned and dressed to a taper, the alignment problem is magnified to such an extent that it may be impossible to produce holes within the same tolerance.

The center lines of the wheel, work and diamond must be in a common plane so that the wheel contacts the work at line "a". If the tapered wheel contacts the work above or below line "a" the wheel will touch only at its

largest diameter and, as the wheel reverses (at the left end of the hole), it will transfer its taper to the work resulting in a tight hole at the back. Turning the workhead or changing the length of traverse cannot overcome this error. Further, because of poor contact, wheel wear will be excessive and finish poor.

If the diamond is set either above or below line "b" (which is a continuation of "a") the wheel will be dressed to a curve (hyperbola) and even if the wheel contacts the work at line "a" it will be only a point contact. Again, the wheel form will be transferred to the work at the point of reversal, wheel wear will be excessive and finish poor. The proper setup calls for the work axis, wheel axis and diamond to be in a plane parallel to the longitudinal and cross motion of the machine.



The Bryant 1109 Precision Internal Grinder is a semiautomatic machine, designed especially for grinding small bores. Although intended primarily for bore diameters of less than 1", it has a chuck swing of 9" and a maximum grinding stroke of 3½". By using preloaded bar slides for both cross and longitudinal slide movements, sensitivity is obtained without loss of rigidity. These rigid slides transmit the operating load directly to the base of the machine. The Bryant Hi-Frequency Wheelhead, providing speeds up to 100,000 R.P.M., is furnished as standard equipment to assure efficient surface speeds on the wheels necessary for griding small bores. Write for further information.

Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.

Internal grinders • Internal & External thread gages

1440

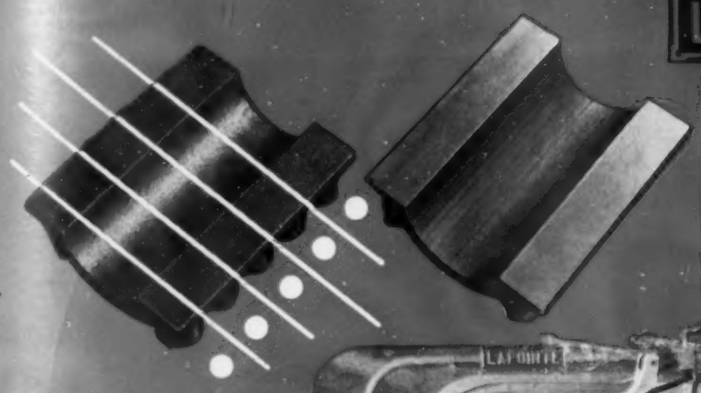
is the production rate in these

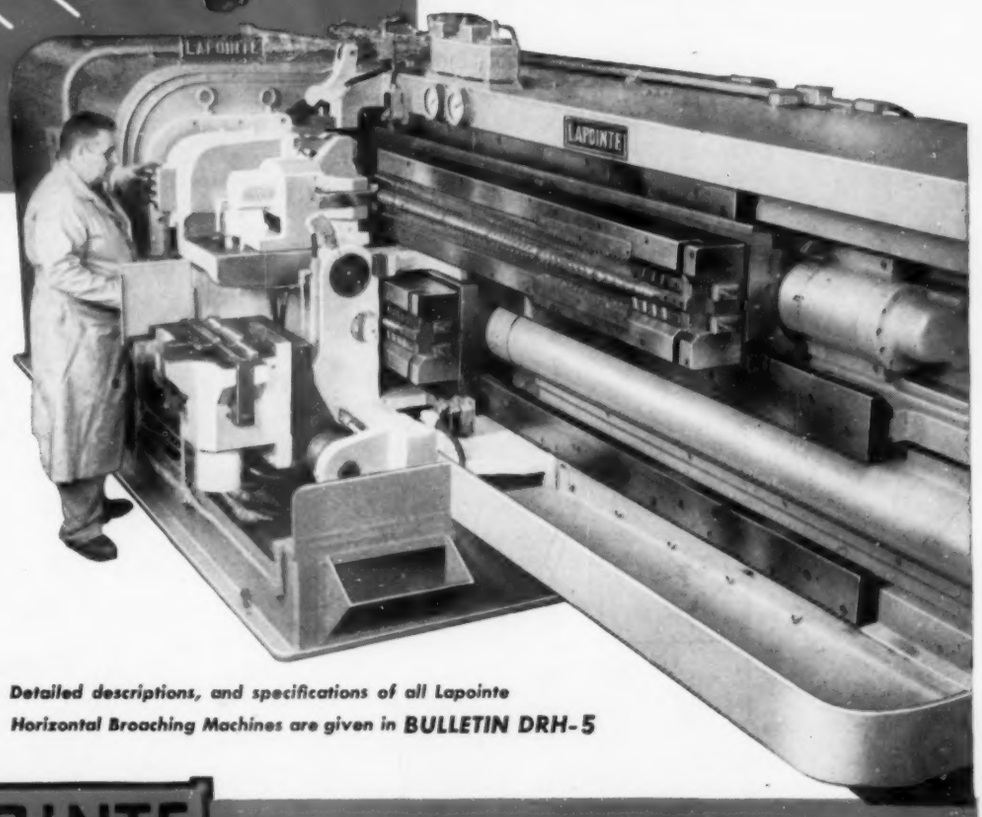
per hour BROACHING MAIN BEARING CAPS

This high production is accomplished on the

LAPOINTE

Double Ram Horizontal Broaching Machine, 15-ton size, with 90-inch stroke
. . . using Carbide Broaches.





Operating at 80 fpm cutting speed, these Main Bearing Caps are broached in clusters of 5, with the half-round, joint faces, and chamfered edges *all broached in one operation!*

SEND FOR FOLDER. *Detailed descriptions, and specifications of all Lapointe Horizontal Broaching Machines are given in* ***BULLETIN DRH-5***

THE **LAPOINTE** MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

Conomatics demonstrate carbide tools

We believe you know that not every "automatic" job can be tooled successfully with 100% carbide. What we think you may not know is that the Conomatic Carbide Development program is making progress with such jobs. This relatively new Cone service is convincing to those who like to be shown that "it can be done".

Granted that experimental runs are not production runs, it has often been proved that under actual production conditions they have developed into production runs. A number of conditions must be met in the successful use of any tooling material. Carbide is no exception. If the comparisons of 100% carbide and HSS runs indicate as much gain as per the job illustrated, the reward is worth the effort.

For full particulars please consult your Cone Representative or inquire direct.

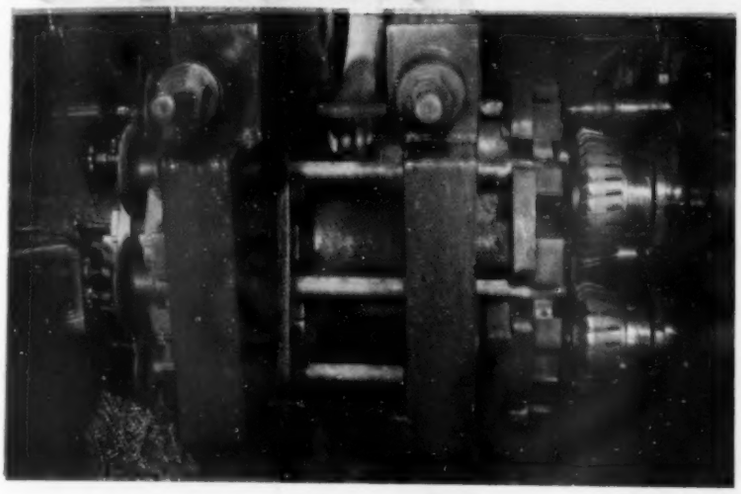
MATERIAL—EVERDURE: (96% copper, 3% silicon, 1% manganese) Hole drilled with 17/32" drill to 1½" depth; thread rolling of ½" pipe thread.

	HSS	CARBIDE
Cycle Time	35 secs.	15 secs.
Work Spindle Speed	420 R.P.M. at 124 S.F.	850 R.P.M. at 250 S.F.
Tool Wear	2000 pcs. per grind	5000 pcs. per grind

The CONOMATIC is the ONLY representative of Frame "A". The short, "weave-proof," upright members, secured between larger and heavier top bed and base, make possible the strongest type of bridged support to the tooling area and its "work and tool axis."

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

THERE IS NOTHING HARDER THAN A DIAMOND but WESSONMETAL IS TOUGHER!



ACTUAL JOB
Large Automobile Plant

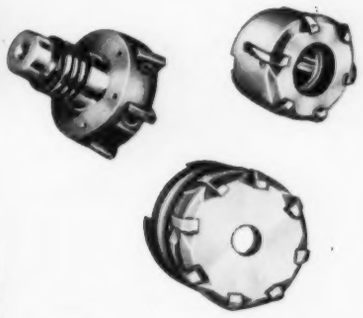
Machine.....Davis Thompson Milling Machine
Part.....Rear axle shaft
Operation....Rough and finish mill spline end
Material.....S.A.E. 1038—Brinell Hardness 179-229
Tools.....Wesson 6" and 8" dia. Milling Cutters—fine pitch—inserted blade
Speed.....8"—387 S.F.M.
6"—290 S.F.M.
Feed.....14" per minute
Production...150 pcs. per hour
1500-1700 pcs. per grind
Grade of Carbide....Wessonmetal WM

SAVINGS OF OVER $14,225 PER YEAR ON ONE MACHINE WITH ONE SET OF WESSON TOOLS

OLD METHOD		NEW WESSON ENGINEERED METHOD	
Cost 1 set Inserted Blades	$48.00	Cost 1 set Inserted Blades	$54.60
Pieces per Grind	275	Pieces per Grind	1600
Grinding Hours per year	10,300	Grinding Hours per year	2500
5 Machines Running 3 Shifts		3 Machines Running 2 Shifts	
Machine Repair per year	$25,000	Machine Repair per year	$1200
Tool Cost per Piece	$.00545*	Tool Cost per Piece	$.00213*

(Machine repair and grinding costs not included)

HOW IS YOUR PRODUCTION SCORE CARD!



Write today for folder on Wesson's educational, full color, sound movie — "This Carbide Age."

Call Your
WESSON SERVICE ENGINEER—

WESSONMETAL Cemented Carbide

WESSON METAL CORPORATION
LEXINGTON, KENTUCKY
Affiliated with WESSON COMPANY, Detroit, Mich.

Special Tools of Quality
Engineered to Save Your Time

DETROIT REAMER & TOOL CO.

2830 E. SEVEN MILE ROAD • DETROIT 34, MICH.

D R & T COMPANY

Production Pointers from GISHOLT

TIME-SAVING IDEAS

Presented as a service to machine shops, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your metal work.

GOOD TWIST FOR ROTOR COUPLINGS

Centering and Holding Simplified by Splined I. D.

This user solved several problems at once . . . by the application of a splined arbor to chuck these steel shaft couplings for turbine rotors. This method provides the firm holding needed for a heavy forming cut, taper boring and other machining. The machine is a Gisholt No. 4 Ram Type Turret Lathe.

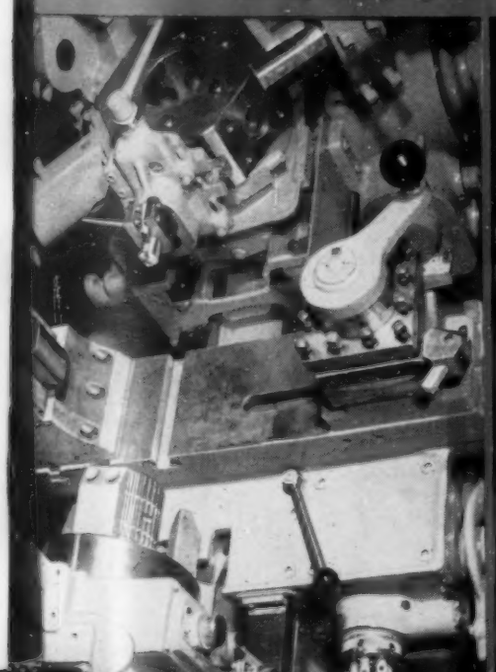
The workpiece is slipped on the arbor against three stops. The splined arbor has a center section that rotates slightly, locking the two splined surfaces snugly to eliminate all play.

The heavy forming cut is done with a dovetail forming tool on the rear of the cross slide. During this cut the workpiece is supported with a live center mounted on the hexagon turret.

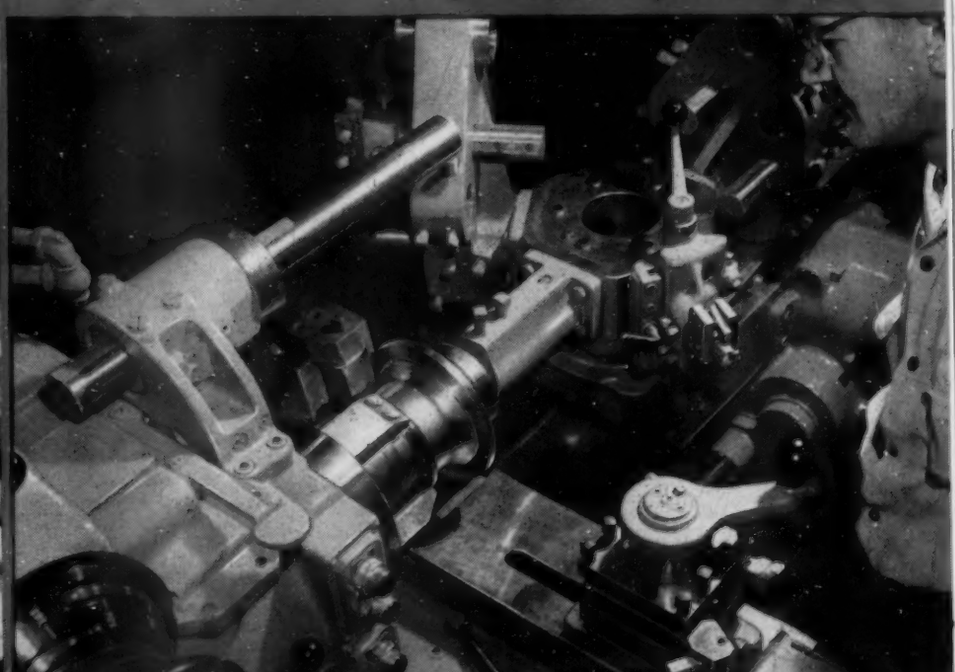
The taper attachment is placed on the front of the cross slide carriage and bores the conical inside surface with the cutter in the square turret. The balance of machining is conventional and is done by tools on the hexagon and square turrets.

On this tough steel workpiece, the tolerances are close, a lot of chips are made . . . yet the No. 4 Ram Type Lathe does the job in only 10.7 minutes, f.t.f.

Splined arbor with rotating locking segment.



Setup for machining rotor shaft couplings. Here, the forming cut is being made.



GISHOLT

TIME-SAVING IDEAS

SMART CHUCKING AND TOOLING COMBINE TO CUT COSTS

DANLY Handles 32 Different Parts on ONE Simplimatic

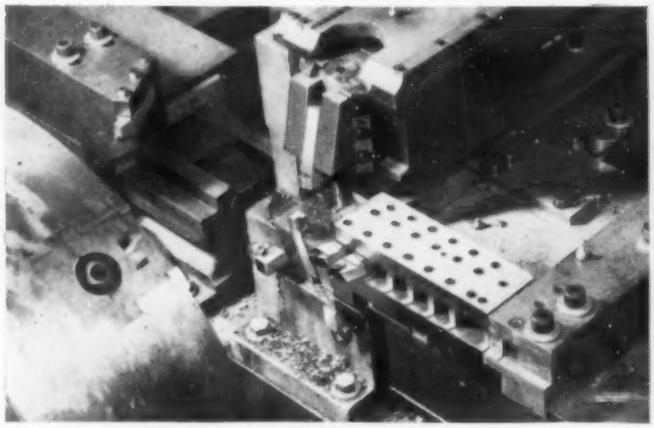
High production of 32 different parts on *one* machine is a neat trick to cut costs—if you can do it . . . particularly when you have square and rectangular shapes to chuck. But Danly Machine Specialties, Inc., largest producer of die maker supplies, is doing it.

The job is machining punch holders . . . and the machine is a 3D Simplimatic Automatic Lathe. The problem of chucking the 32 different sizes was solved by a duplex chuck having two pairs of self-centering jaws which work independently of each other.

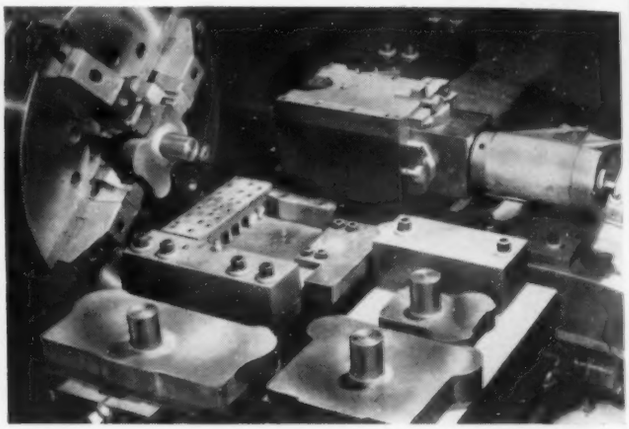
An important aid to production is the front slide with provision for adding tools to accommodate tool travel on the various size workpieces. All 32 types of punch holders are handled simply by inserting or removing tools as necessary.

For the finishing operation, the Simplimatic has a variable speed motor. As the rear slide tool approaches the hub and the diameter diminishes, spindle speed increases. Thus, cutting speed is essentially the same for the entire face of the workpiece.

In this interesting setup, 32 different size parts are handled simply by repositioning chuck jaws and adding tools to the front slide.



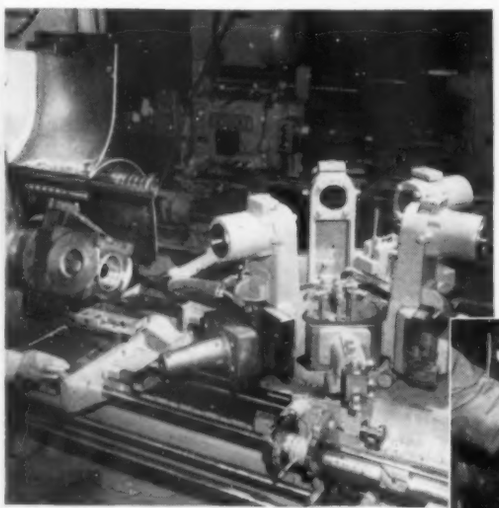
Jaws of chuck operate in pairs to center parts. Note typical workpieces in foreground.



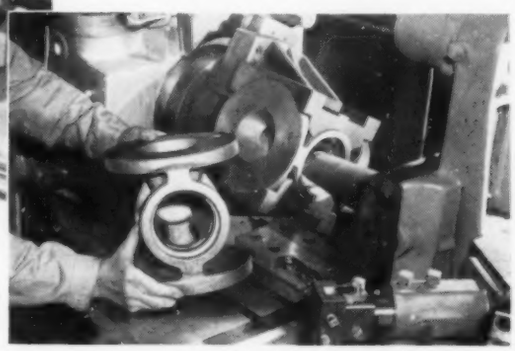
Tooling for machining steel punch holders. Time for workpiece with this setup is only 2.33 minutes.

VALVE BODY PRODUCTION . . . *ON THE DOUBLE*

Features Single Point Tools Instead of Reamer



▲ 2F Fastermatic tooled to machine variety of valve bodies.



Operator holding typical valve body. Note cam-guided boring tool, slide-mounted, on hexagon turret. ▶

Note how this user machines both cast iron and steel plug valves, in a variety of sizes, with this Gisholt 2F Fastermatic Automatic Turret Lathe. The first turret station has a loading arbor to carry the workpiece into proper position for chucking.

Five or six hexagon turret stations are used, depending on the kind of valve body being machined. The tapered seat for the plug is rough and finish bored with single, horizontal slide tools mounted on the hexagon turret. These are guided by an angular cam on the cross slide and held tightly against the cam by sustained air pressure.

In addition to the taper bore for the valve plug, there is boring, facing, and on some workpieces, grooving. Floor-to-floor time for the 2" valve body shown is 11.5 minutes. A single operator easily handles two machines.

The internal taper diameters of these plug valves are bored with repetitive accuracy and finish by cam-controlled single point tools, rather than the usual reamers.

GISHOLT

TIME-SAVING IDEAS

FOUR OPERATIONS ON TWO PIECES WITH SIMPLE CHANGEOVER

Shows Versatility and Speed of No. 12 Hydraulic Lathe

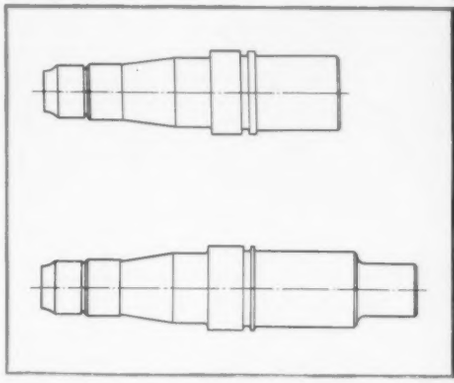
Two different workpieces, each requiring machining on both ends, are handled here with fast, easy changeover. The parts are suspension spindles of nearly equal diameter, but of different lengths. The Gisholt No. 12 Hydraulic Automatic Lathe is the machine handling both.

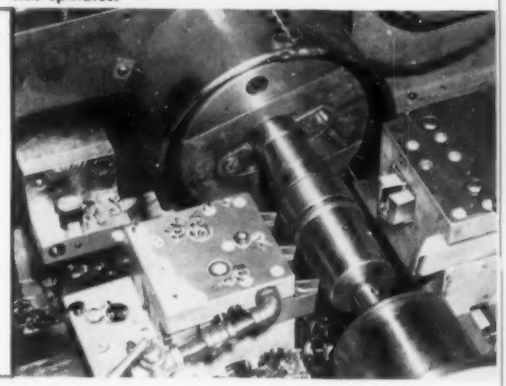
The parts are held between centers and rotated by an automatic workdriver. Variation in the lengths of the two workpieces is provided for by the use of different tailstock centers. By this method the rear independent slide always remains in the same position—minimizing changeover time. Extra dwell for the rear independent slide tools is obtained through an adjustable stop-block. This is screw mounted on the slide and actuates a switch that starts a timer. The timer operates through the main control valve, returning the slide at the end of the timer cycle.

All turning operations on either end of both workpieces are done from the front carriage. Tools on the rear independent slide handle all grooving, facing and chamfering. Time for the first operation on both spindles is 1.60 minutes. For the second operation, floor-to-floor time is 2.00 minutes for both workpieces.

Here's an example of fast, automatic production, with simple changeover on two different parts of varying lengths.

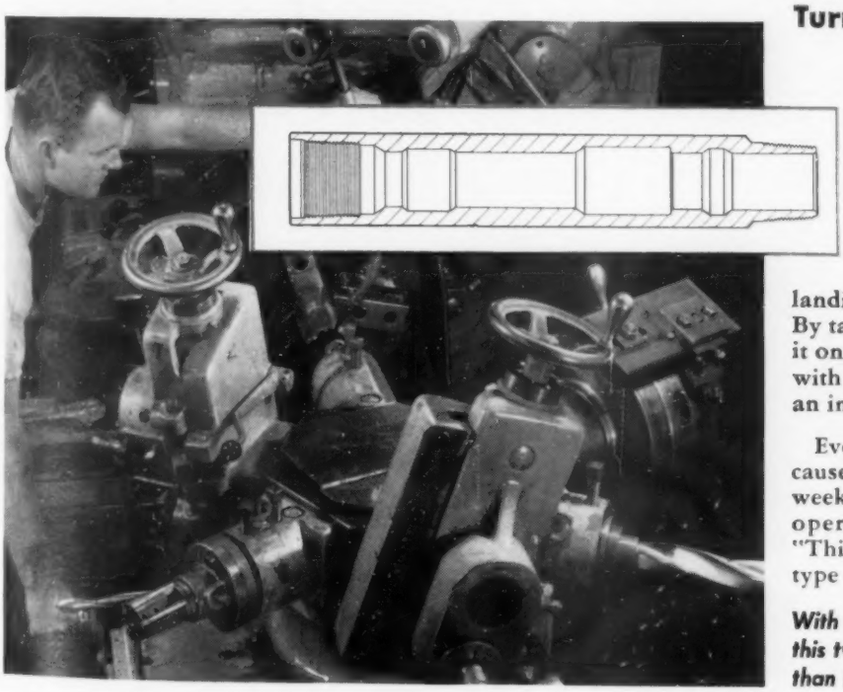
First operation setup for small spindle. Second operation has similar machining on both size spindles.





SIMPLE SWITCH BOOSTS PRODUCTION 50%

Turret Lathe Brings More Tools to Bear on Work



Setup that increased output 50%

One tool at a time is fine . . . up to a point. When you begin to get into a variety of surfaces, such as here, it's time to change.

That's exactly what Otis Engineering Corporation, Dallas, Texas, did in the machining of these stainless steel landing nipples used in deep oil-well work. By taking the job off an old lathe and putting it on a modern Gisholt 2L Saddle Type Lathe with multiple tooling, they were able to make an immediate production increase of 50%.

Everybody is happy about it: The firm, because the machine gives a full 95 hours per week of *lower-cost* production — and the operator, Richard N. Crawford, who says, "This is one of the best turret lathes of any type I've ever operated."

With all stations of the hexagon turret working, this two-operation job is completed 50% faster than by old method.

GISHOLT

GISHOLT

TIME-SAVING IDEAS

SOLVED: A WEIGHTY BALANCING PROBLEM

5-Ton Turbine Rotors Corrected to Accuracy of 2 Ounce-Inches

De Laval Steam Turbine Company, Trenton, N. J., had a three-fold problem in balancing these large marine turbine rotors:

1. Accurate balancing
2. Correction at a rapid rate
3. Prevent scoring of journals

By dropping an older method and doing the job on a Gisholt DYNETRIC Balancer, De Laval answered all three requirements with one machine. The 16-stage rotors weigh 10,000 lbs. and measure 95″ in length and 70″ in diameter.

The balancing and correction functions are tied together. The rotors are balanced to an accuracy of 2 ounce-inches by making correction on two balance rings: On one, excess metal is ground off the heavy side. On the other, where it is not possible to remove material, correction is made by adding plugs of predetermined weight to tapped holes.

In the former balancing method, journals were scored as a result of being carried on rollers. This made it necessary to refinish the journals after balancing. The Gisholt Balancer ended this trouble because the workpiece is properly carried on half bearings.

As to the performance of the Gisholt Balancing Machine, the manufacturer reports, "This Gisholt Balancer replaces one of another type. We now have a safer and faster operation to give us the accuracy we require. The half bearings in the work support have eliminated the scoring of journals."

Faster, more accurate balancing of rotors by this Gisholt DYNETRIC Balancer pays off in smooth, vibrationless operation, longer life.

DYNETRIC BALANCERS GISHOLT

THE GISHOLT BALANCING SCHOOL *teaches the supervisor to plan for faster setups, quicker changeover, and how to get more out of balancing equipment in every way. Write for information. Classes now in session.*

SUPERFINISHING IMPROVES QUALITY OF TRANSMISSION PARTS

Faster, Less Costly Than Former Process

How to achieve fine finish on these high-quality automatic transmission parts? This manufacturer turned to Superfinish—for speed, efficiency and low cost.

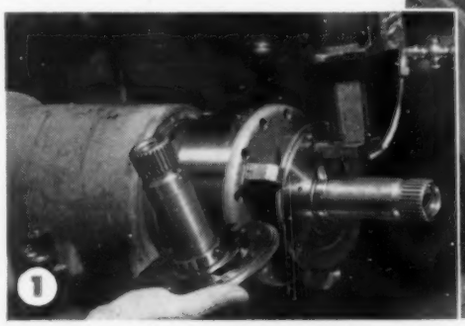
Here's how it's done:

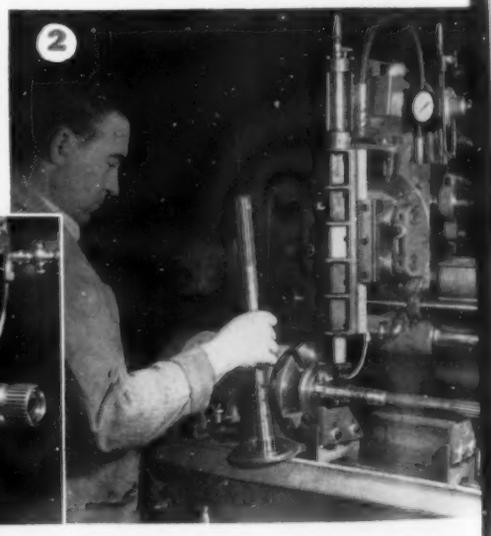
First photo shows a flanged hub in the Gisholt 52-A Superfinisher. To hold the assembly, the chuck is mounted on a special face plate. The Superfinish Stone-Carrying Quill has extra travel to provide clearance for easy loading and unloading. For Superfinishing the bearing surfaces, two speeds are used—a 10-second roughing cycle and a 15-second finishing cycle. Except for the loading and removing of parts, the machine is fully automatic with a predetermined and adjustable cycle.

To do the shafts shown in the second photo, changeover is this quick and easy: The chuck is removed, and a standard driving plate is mounted on the spindle. Loading of the longer workpiece is aided by two adjustable loading rails. The workpiece is held between a headstock dead center and a tailstock live center.

Superfinishing cycle-time is the same for both parts. Production is at the rate of 70 per hour at 80% efficiency. In both cases, bearing surfaces are Superfinished to 3 to 4 micro inches R.M.S. from a ground finish of 15 to 20 micro inches R.M.S.

In one fast, automatic operation, Superfinish rids vital bearing surfaces of smear metal, grinder flats, etc., to insure smoother, longer life. Here's not only low production cost, but also low machine investment.





No. 7-853
613

GISHOLT

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

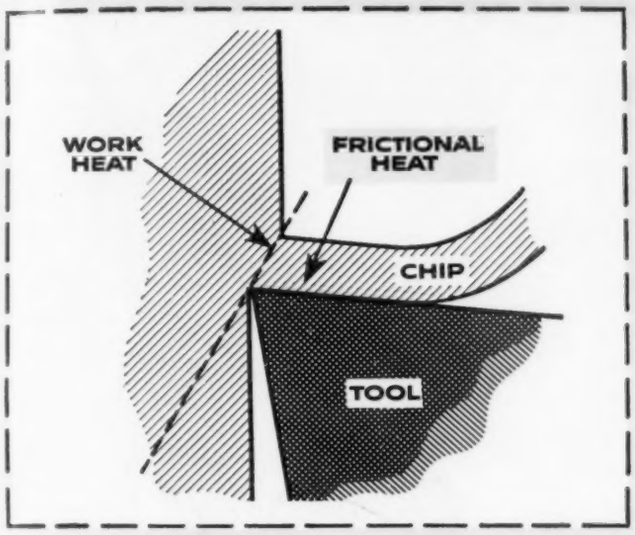
Write for your copy of Gisholt's new general catalog.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

JOHNSON'S WAX-COOL ATTACKS FRICTIONAL HEAT

New water-soluble coolant effectively lubricates at tool-chip interface.



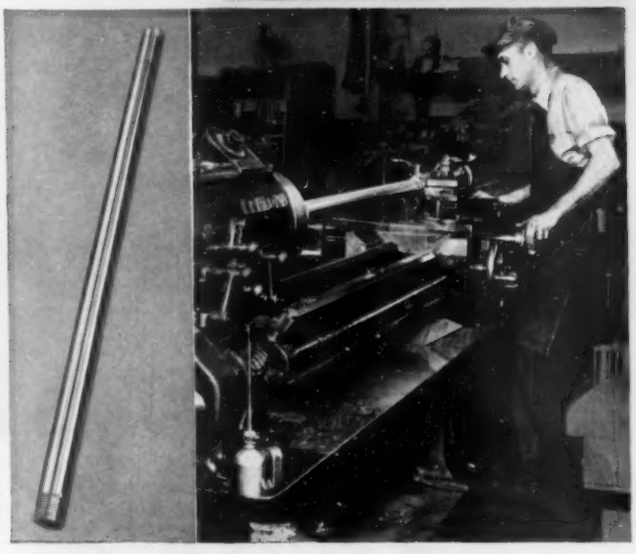
1. WAX-COOL stays with tools and material even at temperatures up to 450°E and pressures up to 200,000 P.S.I.

2. WAX-COOL prevents chip weld because work runs cooler.

3. WAX-COOL effectively minimizes frictional heat which is by far the principal source of heat.

Because of the greater lubricity of certain waxes and their high polar attraction for metal, Wax-Cool is the first coolant to greatly reduce frictional heat at the tool-chip interface. Wax-Cool also has the heat carry-off properties of ordinary coolants—to check work heat generated in the shearing zone.

HERE IS PROOF!



Wax-Cool is being used effectively on this tough job at the E. J. Longyear Company, Minneapolis. They are turning down the external surface of a 4'6" length of #2320 steel tubing. One rough and one finish cut. On a 15-piece run it took 3 days with 4 pieces of scrap, and a poor finish. With Wax-Cool the job was done in 2 days with no scrap and a mirror finish. They used to cut halfway and reverse the tube in the lathe. Now they cut its full length for a straight, accurate cut.

Wax-Cool created these savings

One day saved on a job that used to take 3 days
No scrap
Mirror finish right from the lathe
Tool life doubled
No hot chips to handle

A test is your best proof

See for yourself how Johnson's Wax-Cool can give you economy and performance you never dreamed possible. Real savings in tools and time make Wax-Cool inexpensive to use. Call your local Johnson distributor, or write to:

INDUSTRIAL PRODUCTS DEPT. TE 8
S. C. JOHNSON & SON, INC., RACINE, WISCONSIN

Ask **about Wax-Cut**—*wax-type cutting oil for automatic screw machines, gear cutting machines, etc.*

Ask **about Wax-Draw**—*wax lubricant for drawing and forming all types of metals.*

SCULLY JONES Recessing Tools

Chamfer both sides of crankshaft bores at same time, produce 720 pieces per hour!

Speed and simplicity get together on this special Hartford Crankshaft Bore Chamfering Machine . . . "factory-equipped" with Scully-Jones Type "J" Recessing Tools.

Four Recessing Tools automatically position the tool bits inside the bores, control depth of cut precisely for putting 45° chamfers on both sides of connecting rods. Production, at 85% efficiency, is 720 rods per hour!

Simplicity of tooling and extreme ease of setting depth adjustment are outstanding production advantages on this high-speed chamfering job. The eccentric tool holders pilot in special Oilite bushings. Lead cams automatically actuate feed stroke. Operator merely loads the machine and pushes "start" button. Scully-Jones carbide-tipped tool bits produce eight precise chamfers on each cycle, hold sharp edges over many cuts.

Whether you're a builder or buyer of machine tools —you can reduce costs of intricate machining operations with Scully-Jones Automatic Recessing Tools. Ask your Scully-Jones representative or stocking distributor for complete details and prices.

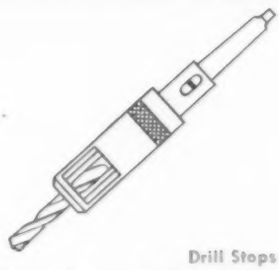
AUTOMATIC RECESSING TOOLS reduce cost of intricate operations, such as: cutting reliefs for tapping, threading, honing and grinding . . . machining retainer rings and oil grooves . . . chamfering . . . back-facing and counterboring . . . necking . . . boring . . . or a combination of these operations on standard drill presses, radial drills, turret lathes and chucking machines.

CLOSE TOLERANCES are assured; adjustments for location and depth of groove are simple, fast, accurate. Eccentric cam action gives positive feed.

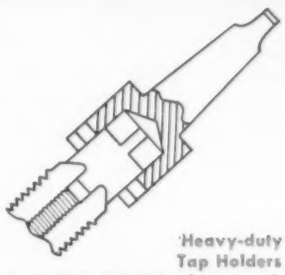
HIGH PRODUCTION is achieved by rapid positioning of tool and fast cutting cycle. Hence, with a convenient chucking method, you get fast, low-cost production.

Scully-Jones Type "J" Automatic Recessing Tool
Types "J" and "C" pilot in a fixture bushing. Type "R" pilots in, and stops on work.

THERE'S A SCULLY-JONES PRECISION TOOL FOR EVERY HOLDING OR DRIVING NEED . . .



Drill Stops
Stop tool on work or fixture bushing, control depth of hole precisely on turret lathes and radial drills.



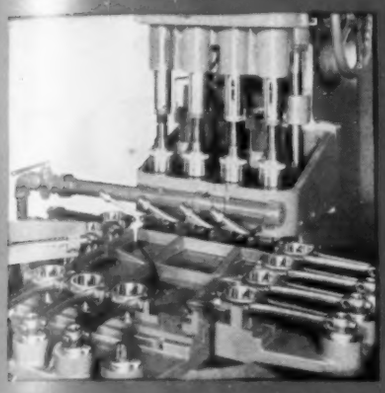
Heavy-duty Tap Holders
For holding and driving large taps in standard machines having Morse taper hole. Keep taps running true.

Precision Sleeves and Sockets
Reduce any A.S.A. or Morse taper hole to smaller taper. Hardened and ground on inside and outside surfaces.

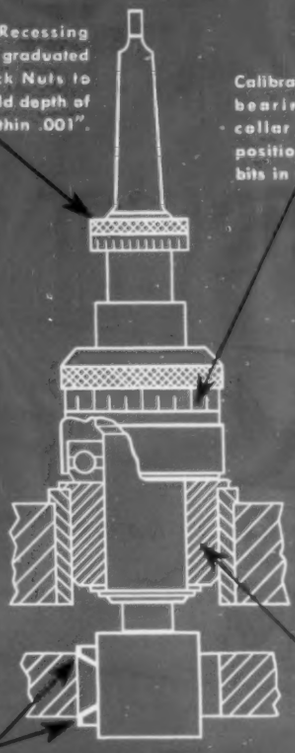
Counte... ...ses
High-speed steel or carbide-tipped cutters with stub taper drive give you fast, easy tool changes.

...do "inside job" for HARTFORD

HARTFORD Crankshaft Bore Chamfering Machine, built for The Studebaker Corporation, has four stations: 1) load, 2) idle, 3) chamfer four rods, and 4) unload. Machining four pieces per load, Scully-Jones Recessing Tools produce eight 3/64" chamfers each cycle. Builder: The Hartford Special Machinery Co., Hartford 12, Conn.



Calibrated adjustable stop collar assembly quickly locates position of tool bits within .001". Adjustment for depth of chamfer is built into the machine.



SCULLY JONES

Precision Holding

FOR HOLDING PRECISION

Scully-Jones and Company, 1915 South Rockwell Street, Chicago 8, Illinois

MORE FACTS—Send for free catalog describing Scully-Jones Recessing Tools. Paste coupon to letterhead or postal card and mail today.

Gentlemen: I'm interested in learning more about Scully-Jones Precision Holding and Driving Tools.

- ☐ Please send Bulletin 10-50 describing Automatic Recessing Tools.
- ☐ Send catalog on your complete line.

Name_____

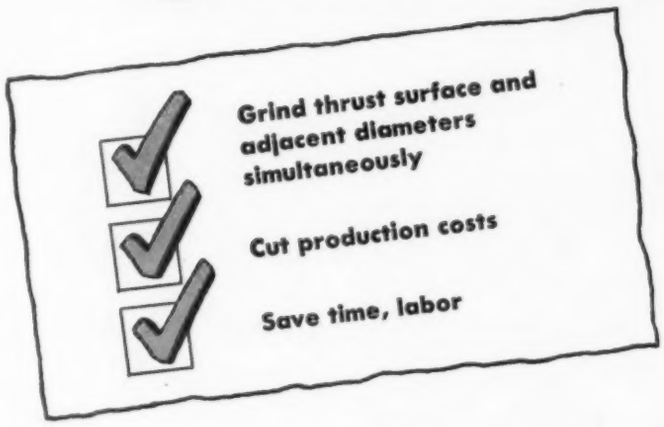
Company_____

Address_____

City_____ State_____

TWO GRINDING JOBS AT ONCE

You get the "TOUCH OF GOLD" with Norton 6" or 10" angular wheelslide grinders



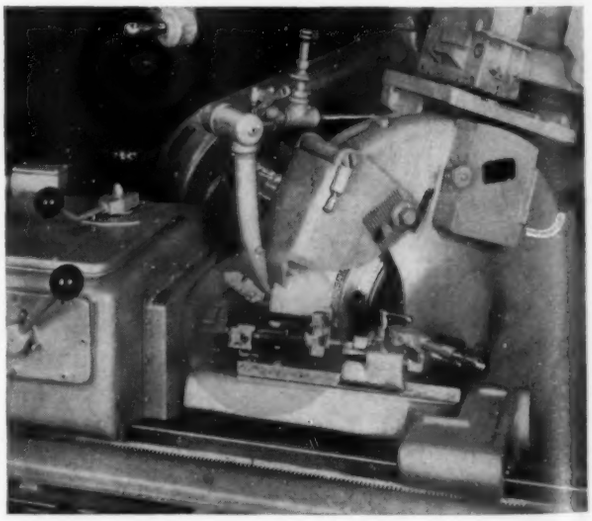
Now you can grind thrust surface and adjacent diameter *in one automatic operation.* And with these Norton hydraulic semi-automatic cylindrical grinders you'll get the value-adding "Touch of Gold" on *both* jobs — assuring you more accurate, finer finished products. "One lever" cycle control helps your operators produce more with less effort, while other special features simplify maintenance and servicing. Also, you get concentric grain pattern in finish of thrust surface — assuring a better surface than side wheel grinding.

These time- and labor-saving standard Norton angular wheelslide grinders can also be adapted for *special* jobs, thanks to special Norton devices. Remember, too, that these are but two of many Norton machines, *representing the world's most complete line of grinders . . .* products of Norton engineering leadership.

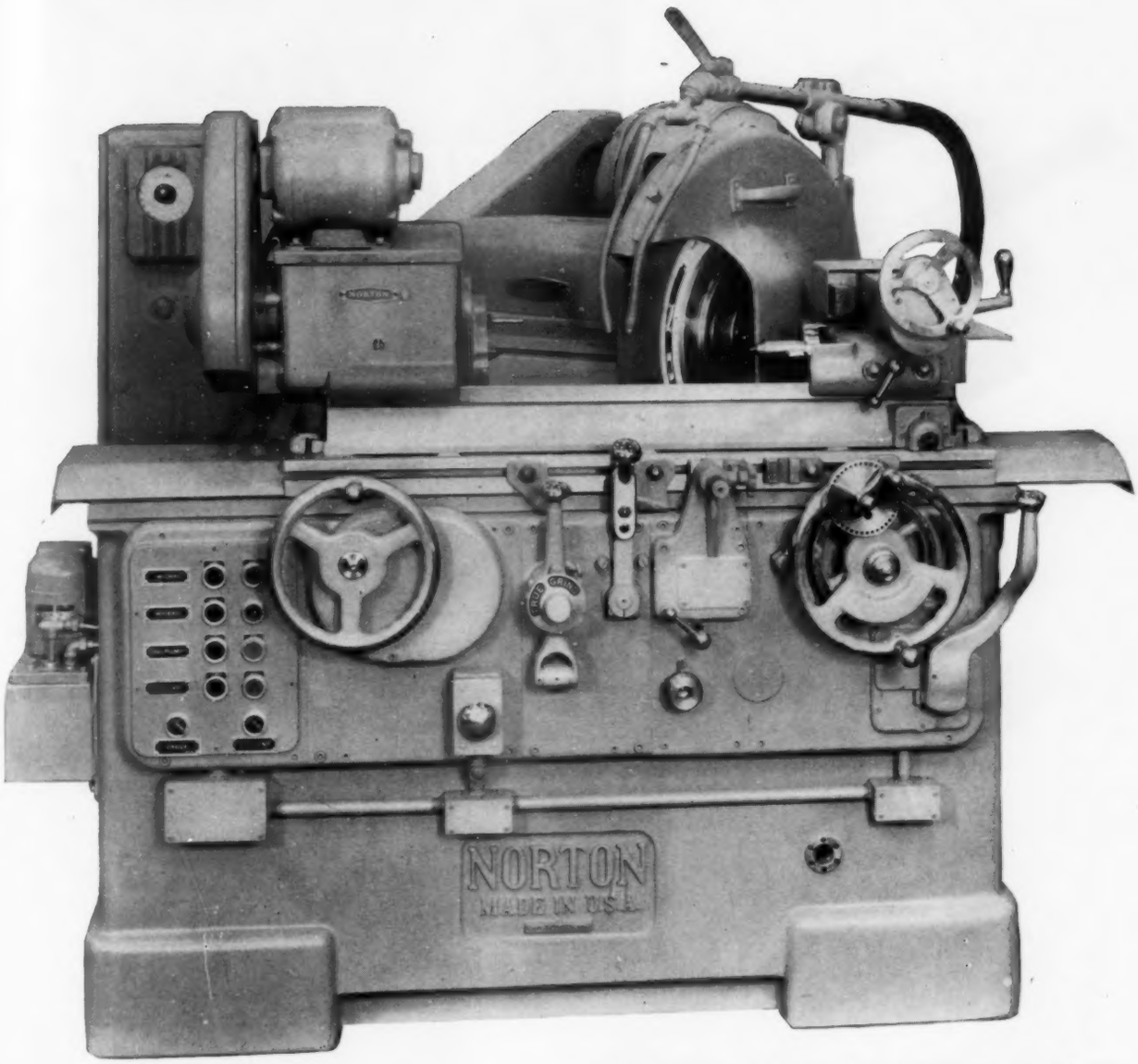
Only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost . . . to add the true "Touch of Gold" to every grinding job you do.

If you're planning now for "post-emergency" production, we will be happy to discuss with you your requirements in grinding machines and to fit tentative delivery schedules into your plans.

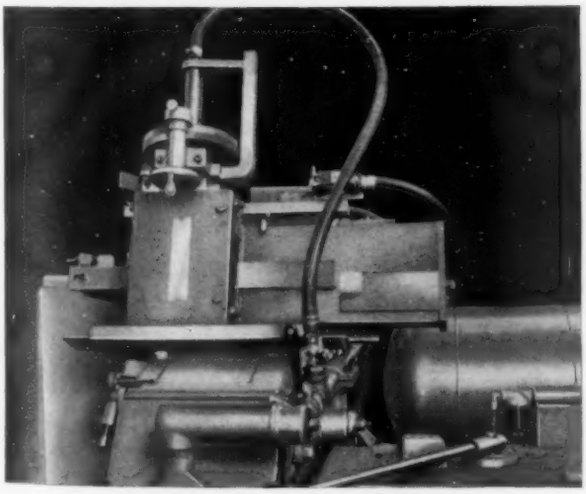
For further information on the Norton 6" or 10" angular wheelslide grinders ask your Norton Representative for Catalogs 533 and 1793, or write us direct. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.



THIS NORTON CAM-O-UNIT MECHANISM on a 10" angular wheelslide machine is typical of how Norton engineers can adapt standard machines to special jobs. Unit shown is grinding the radius and platform surfaces of jet engine blades.



NORTON ANGULAR WHEELSLIDE MACHINE makes one job out of two by grinding thrust surface and adjacent diameter simultaneously — adding the product-improving, cost-cutting "Touch of Gold" to two operations at once! Pictured above is standard 6" angular wheelslide machine.



NORTON'S WHEEL GUARD TRUING DEVICE replaces hand-operated equipment, decreases effort, time, and skill needed to true wheels. It increases production, wheel life, diamond life, and is easily built into Norton angular wheelslide grinders.

Truing is automatic, the operator merely pushes a button.

lot of *standard* Morse End Mills would be specials in anybody else's catalog!

Want them short and stubby, or long and lean? Or with ball-end for die cavities, fillets, and round-bottomed holes and slots? Or with *left*-hand spiral but *right*-hand cut to push chips ahead? Morse makes all these, *and more* . . .

For instance, Morse also makes them with two flutes, cleared to cut to center for plunge-cutting . . . with taper shanks to fit machine spindles . . . and in shell types for face or slab milling cuts. Not to mention a complete size-range in the exclusive shear-cutting design known as Morse Hi-Helix.

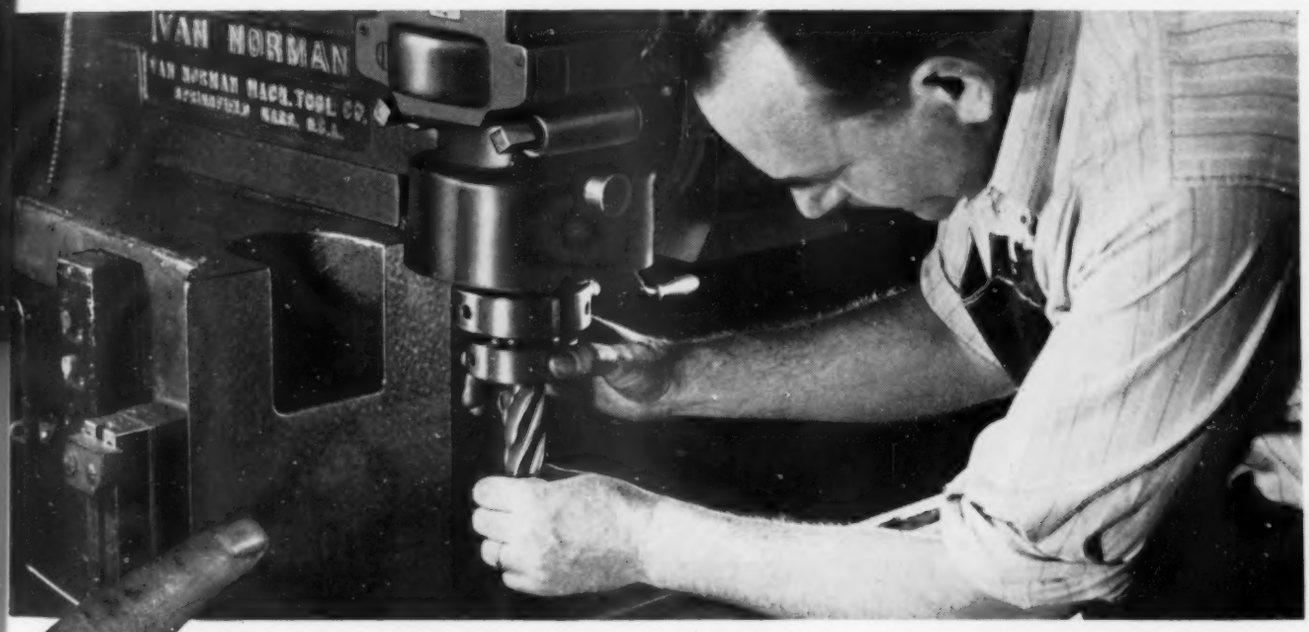
So if you want an end to your end-mill problems, get hold of your Morse-Franchised Distributor. He has every type you could possibly need . . . and he knows how to engineer it to your job. *Call him now.*

MORSE TWIST DRILL & MACHINE COMPANY

NEW BEDFORD, MASSACHUSETTS

(Division of VAN NORMAN CO.)

Warehouses in New York, Chicago, Detroit, Houston, San Francisco



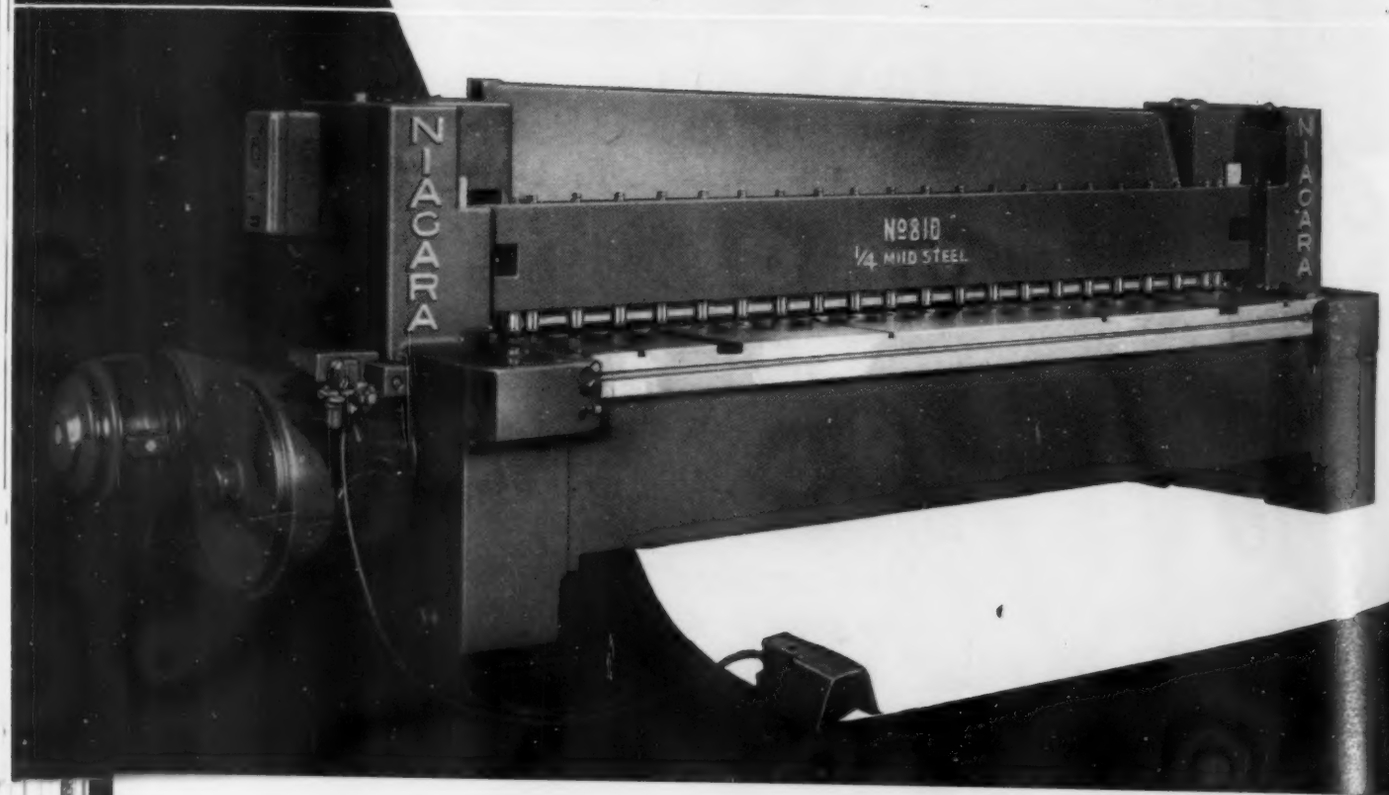
MORSE

Cutting Tools

Buy them by phone from your Morse-Franchised Distributor and save ordering time

NIAGARA SHEARS

at General Sheet Steel Co., Detroit, Mich.



Only CARBORUNDUM gives YOU

NIAGARA

POWER SQUARING SHEARS

after shearing
thousands of tons
of steel
of all kinds

LET'S LOOK AT THE RECORD!

NIAGARA
Shears are designed for
HIGH VOLUME SHEARING
ACCURACY
DEPENDABILITY
LOW MAINTENANCE COSTS

Write for Bulletin 69

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.
Manufacturers of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work
DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK • PHILADELPHIA
Dealers in principal U. S. cities and major foreign countries

DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK • PHILADELPHIA

Dealers in principal U. S. cities and major foreign countries

so wide a choice of abrasive tools

You get UNBIASED COUNSEL based on all abrasive methods

Your business, in mass production of parts or finished assemblies, is the problem of generating close tolerance sizes, of producing high surface finishes, of removing stock. The business of CARBORUNDUM is the exclusive ability to recommend and furnish you the specific type of abrasive product which will give you highest quality at lowest cost, on every operation you perform.

Take off-hand grinding, for instance. You can count at least 7 different abrasive methods of off-hand grinding. How can you be *sure* the method you are using is the best —the lowest in cost? By asking CARBORUNDUM... for CARBORUNDUM alone has a complete, branded line of grinding wheels *and* abrasive belts *and* tumbling and polishing grains. Only CARBORUNDUM can recommend without bias, on the sole basis of what's best for you.

Or suppose you manufacture fountain pens. You can finish and polish the barrels with abrasive belts or grinding wheels... you slit the points with a tiny grinding wheel... finish the clips with tumbling abrasives. CARBORUNDUM alone gives you *one-source control* of abrasive quality, on every type of abrasive you use...quality that's constant, identical, dependable—thus economical.

Several ways to do one operation? Call in CARBORUNDUM. Several processes on one part? Call in CARBORUNDUM. Either way, you win.

Call your CARBORUNDUM *Salesman or Distributor* today!

He's your best bet for complete stocks, prompt delivery... and best of all, experienced counsel on *every* new development in the *entire* field of abrasives. He's in the yellow pages under "Abrasives" or "Grinding Wheels." Phone him today—it's to your profit!

Ready now—your free copy of the new big COATED ABRASIVE SELECTOR catalog... containing detailed recommendations for both machine and hand sanding operations on tough and soft metals, glass, plastic, wood. Phone for it today.

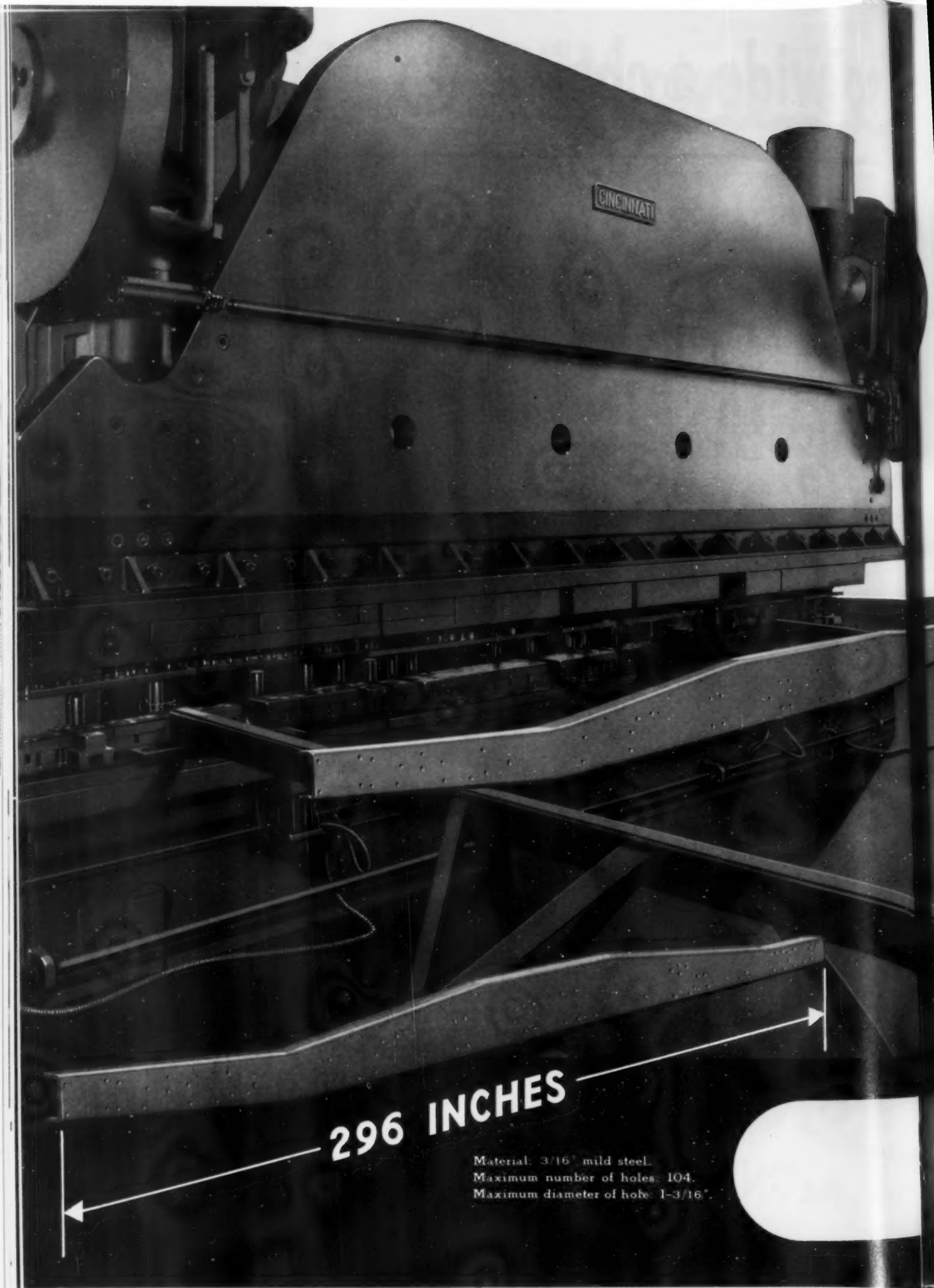
RUNDUM

MARK

... the ONLY source for EVERY abrasive product you need

80-34

RUNGUNG



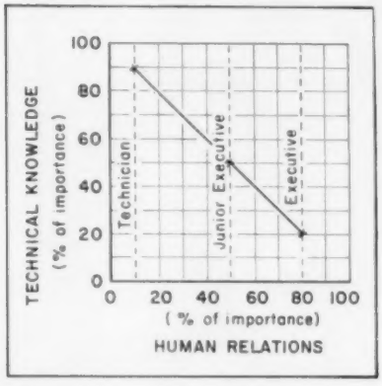
Material: 3/16" mild steel.
Maximum number of holes: 104.
Maximum diameter of hole: 1-3/16".

Another **TOCCO®** *First!*

The Tool Engineer

How Does The Tool Engineer Function?

It is impossible for the tool engineer to separate himself or his work from people and professional problems. His primary functions are: analysis, planning and execution. Analysis and planning require mechanical knowledge, technical experience and judgment. Execution brings a new factor into consideration—people. Purchasing, organizing and supervision come into the picture. Also, a tool engineer must sell his plans and ideas to the industrial designer as well as to the production supervisor.



Arthur A. Merry, Chief Advanced Tool Engineer, Pratt & Whitney Aircraft Div. and a long-time ASTE'r told us recently that we do not put enough emphasis on human relations, salesmanship and management. He called attention to a recent report on promotions—that more and more emphasis is placed upon *the person*, how he gets along with others—how he can sell his ideas to others in his company. To illustrate the increasing importance of human relations as the engineer progresses in management, the accompanying chart shows the ratios between technical knowledge and human relations required for the technician, junior executive and senior executive.

Mr. Merry pointed out that a good engineer often didn't know he lacked such important qualities and that ASTE should teach him more than just engineering subjects. This makes sense. You will see more such subjects from time to time in this magazine and in other ASTE activities.

R. F. Waindle

PRESIDENT
1953-1954

1. Crank cheek is loaded in left head, crank is loaded in

Automation
Assures Precision Assemblies

By C. F. Hautau*

Chief Engineer
Hautau Engineering Co.
Detroit, Mich.

UNTIL RECENTLY, automation has generally been applied in those industries producing heavy products not requiring extreme precision or products involving relatively high production. Low production, high precision and close tolerance products are usually assembled by time-consuming and expensive handwork.

Automation can also effect surprising savings, in precision manufacturing, and the resulting precision can exceed human capability. An excellent example of the improvement that may be gained by automating an awkward, low production hand operation, is the assembly of a radial engine crankshaft by the machine illustrated in *Fig.* 1. This crankshaft involves six component assemblies, *Fig.* 2, as:

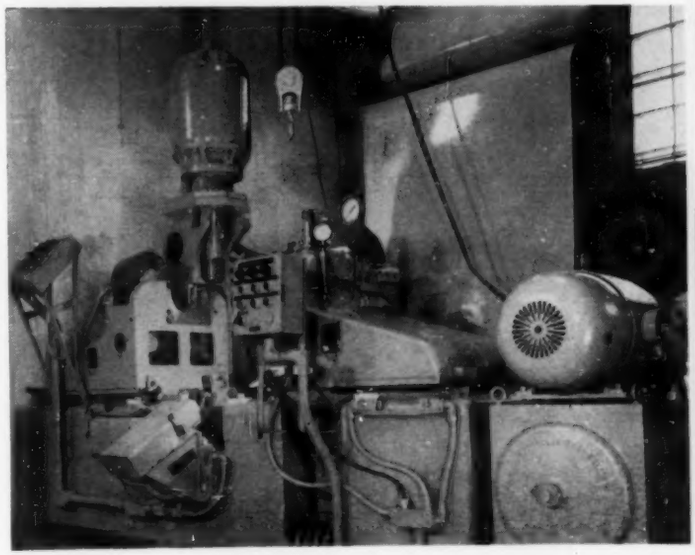
1. Crankshaft proper, having 2 throws, one each for front and rear crank cheeks.
2. Rear crank cheek and brass counterweight.
3. Front crank cheek and brass counterweight.
4. Rear connecting rod cluster including master rod.
5. Front connecting rod cluster including master rod.
6. Center crankcase.

For hand assembly the following procedure is generally required. The main crank is clamped in a jig mounted on an assembly bench. Then the first rod assembly is positioned on the crank journal. After spreading the crank cheek yoke with a drift pin, the cheek is mounted on the main crank. When approximate alignment of main bearing journals is obtained, the drift pin is removed to permit the crank cheek to seize the shaft. Then alignment is checked by spinning and measuring runout. When satisfactorily positioned, a bolt is inserted in the yoke and torqued. Proper torque is indicated when an index pin will drop into a predrilled hole in the bolt. Runout is then checked again. If unsatisfactory, the bolt is loosened, the assembly is tapped with a hammer, the bolt is retorqued and runout is rechecked. This operation must be repeated until within limits.

To install the main bearing the assembly is unclamped, turned end for end and reclamped. After assembling the main bearing, the center crankcase is installed. Then the other crank cheek is installed, involving duplication of all the steps involved in mounting the first crank cheek. If runout of the center crankcase is excessive, complete disassembly and reassembly is necessary to secure proper limits.

This kind of assembly is constantly attended by the problems of obtaining skilled workers and using

Fig. 1. This machine assembles six component parts in 4 percent of the man-hours required to perform the operations manually with highly skilled workmen. In addition, quality and precision of assembly are assured with positioning devices and quality checks.



*Senior member ASTE Detroit Chapter

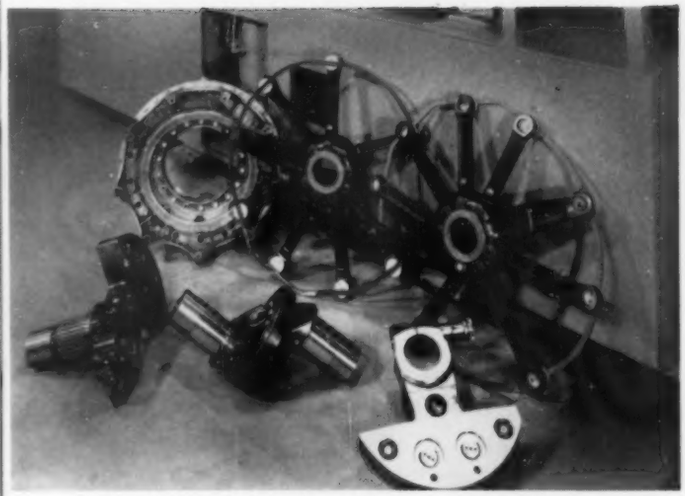


Fig. 2. The six components of a radial engine crankshaft assembled by the machine in *Fig.* 1. These components are center crankcase, two identical connecting rod clusters, left crank cheek, crank, and right crank cheek.

methods that require a strong element of art in addition to good practice. Automating these operations with the machine shown in *Fig.* 1, reduces personnel and skill required, assembles all parts accurately without any need for disassembly, increases production rate and occupies less floor space.

Machine Features: The machine is designed with five principal cooperating components: (1) left head, (2) center head, (3) right head, (4) left torque unit, and (5) right torque unit. The machine cycle is as follows:

1. Crank cheek is loaded in left head, crank is loaded in center head, forward crank cheek is loaded in right head, *Figs.* 3 and 4.
2. Rod assembly is slipped over journal, and left head presses rear cheek over journal.
3. Bolt is installed and hydraulic motor applies proper torque, *Figs.* 5 and 6.
4. Center crankcase is positioned in place and first three steps are repeated with the forward cheek.
5. Assembly is unloaded.

The entire machine is mounted on a sub-base so designed that the bottom of the machine is level with the floor. The base proper is a sturdy skin-stressed weldment with radii and rounded corners.

Left and Right Heads: These components are mounted on hardened ways, allowing each head a travel of 8 inches toward the center head. Both heads are identical in construction and are aligned precisely on the same axis. Each head is a Meehanite casting of ½-inch wall thickness throughout. A heavy brass block insert, having a semicircular half-bearing, precisely line bored, is mounted on each head. A brass faced locking clamp, *Fig.* 7, rotates in from the side to provide hydraulic clamping pressure on the journals of the crank cheek.

On a horizontal plane, crank-throw distance away, is provided a brass, diamond-shaped locating pin, *Fig.* 8, which is spring loaded. As the crank cheek is pressed on, this locating pin orients the cheek exactly with the throw. By preceding the operation and entering the hollow connecting rod journal, the pin guides the cheek as it accepts the crankshaft.

Fig. 3. Left head and center head of machine with clamps in loading position.

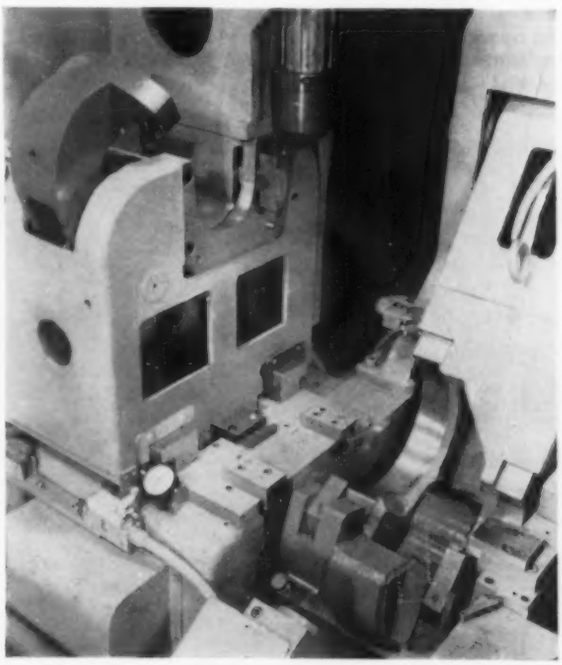
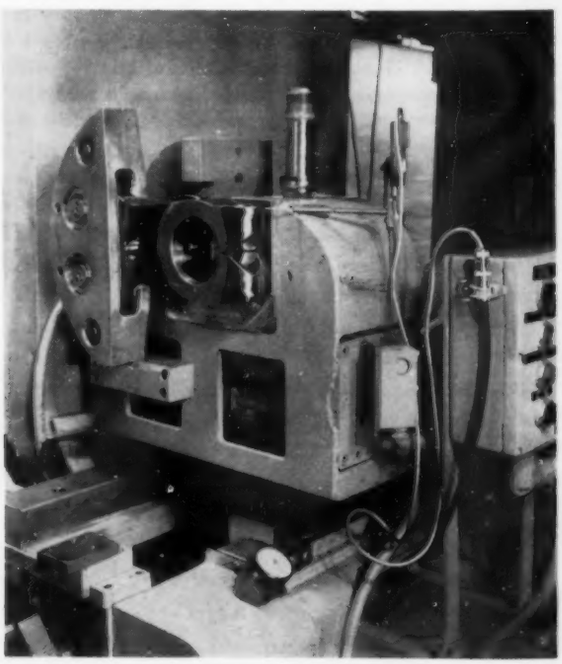


Fig. 4. Right head of machine with crank cheek in position. The torque indicating pin enters a drilled hole in the bolt when bolt is assembled and properly torqued. Torque unit, being under the head, is not visible on this head.



On the side of each head is mounted a small hollow tube for the torque indicating pin, *Fig.* 9. Its axis is oriented so that, when the bolt is tightened to its final position, the pin guided by the tube drops into a predrilled hole in the bolt. This pin is spring loaded by a wand with a limit switch attached which stops the torque motor when the pin enters the bolt.

Beneath each head is mounted a unique, positive lock-out device, *Fig.* 10, that provides the exact clearance for the rod assembly hub. Formerly, this clearance between the rod assembly and crank cheek was obtained with feelers in a place that had poor access. The machine, however, automatically supplies the exact clearance in the following manner:

1. Head advances, pressing crank cheek and rod assembly hub on journal against end thrust surface, thus driving out all play and lash between hubs and cheek. Simultaneously bolt on head enters lock integral with base.
2. Bolt is locked by wedge system.
3. Head withdraws, traveling backward until stopped by preset shoulder on bolt.
4. Yoke is clamped in place on journal at exact preset clearance.

Center Head: The center head is merely a cradle arm, *Fig.* 11, to receive and hold the crankshaft until the first crank cheek has been assembled and torqued. It is hinged at the back of the machine, and sweeps upward to be shot-pinned into its operating position. It holds the crankshaft in exact alignment with the front and rear heads. Immediately following the mounting of the first crank cheek, the center head is retired by a hydraulic cylinder leaving the entire assembly cantilevered and clear of obstruction for the succeeding assembly operations.

Torque Units: Two specially designed and specially built hydraulic oscillating motors, having a 270-degree working arc, are mounted vertically on the left and right heads in alignment with the cheek bolt hole. The 3½-inch diameter splined shaft advances under air power a distance of 9 inches to engage and torque the bolt, providing a maximum possible torque of 120,000 lb-inch under 1000 psi pressure. The left head torque motor is mounted above the machine, the right head motor is below the machine.

Producing a torque on the bolts of an exact value was solved in a unique and interesting manner. Specifications require that the bolt be stretched a specified 0.008 inch. This is a critical dimension and must be approached as closely as possible. In a manual assembly method a bearing ball is placed in the conical recess at each end of the bolt. The bolt is alternately torqued and measured for elongation with a micrometer over the balls. This operation is repeated until the desired elongation is obtained. The undesirable aspects of interrupted torquing of bolts are commonly known and the problems that result can be appreciated.

This same operation is accomplished in the following manner in the machine: When ready for torquing, the operator places a torque indicating pin in the tube provided in the head, *Fig.* 9. The spring loaded wand is rested on the pin, giving it a load toward the bolt. An electric indicator is threaded through the hollow bolt.

Fig. 5. View of the left and center heads. After rod cluster is assembled, left crank cheek is pressed in place and bolt is torqued.

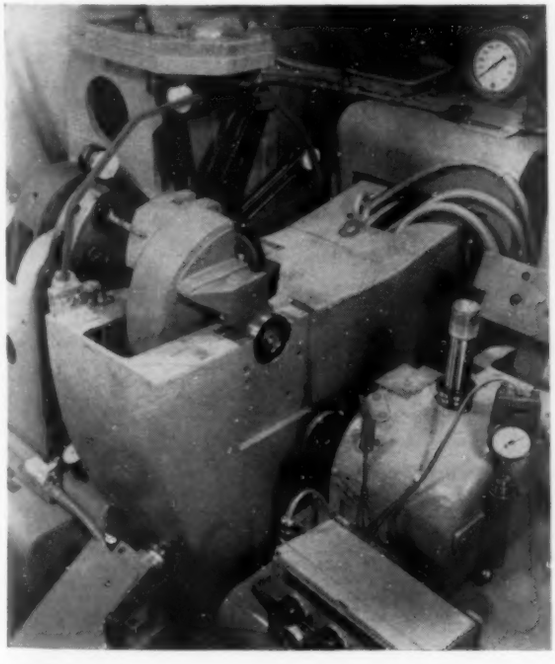
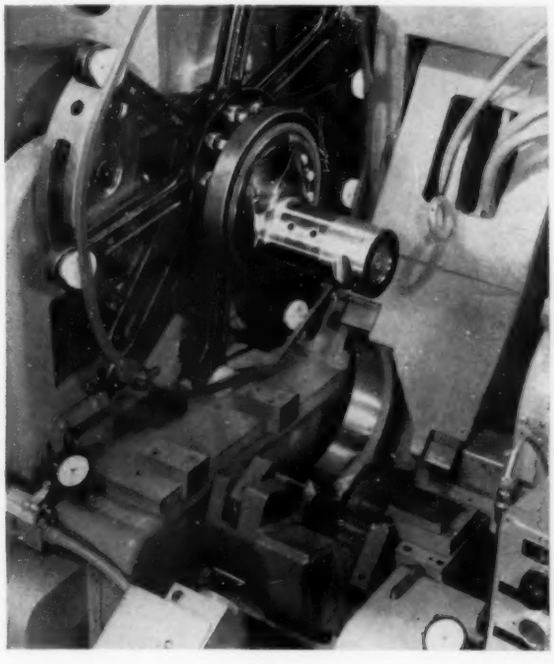


Fig. 6. After operations shown in *Fig.* 5 are completed, the center head is opened to allow assembly of center crankcase and other rod assembly.



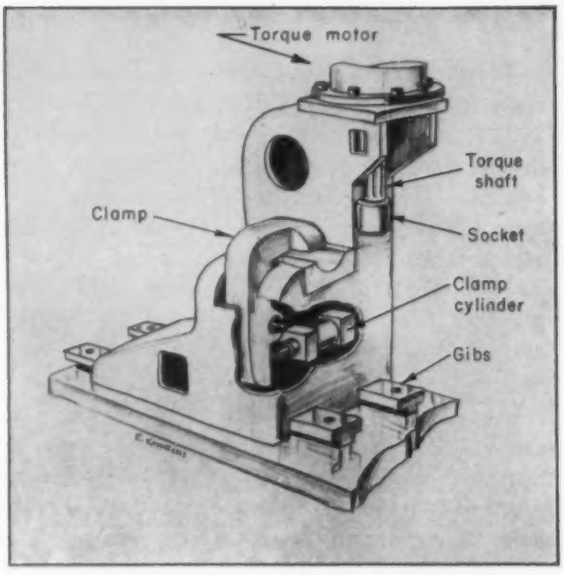


Fig. 7. Cutaway view of left head showing operation of clamp. Torque motor, shaft and socket are used to correctly stretch the left assembly bolt.

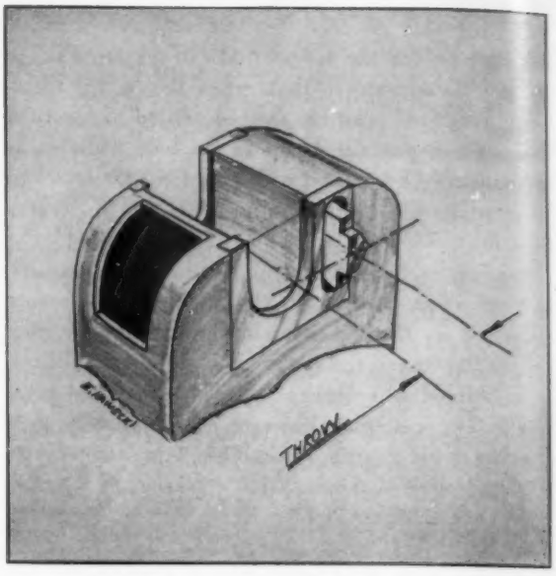


Fig. 8. Detail of locating pin on left head that accurately locates and guides the crank cheek in proper relation to the crank throw during assembly.

When the torque button is depressed, the torque motor shaft advances, engages the head of the bolt and torques it to the preset value. As soon as the proper value is reached, electric indicator signals light and the torque indication pin goes home through the hole in the bolt. This last action stops the torque motor and withdraws the shaft. The most interesting feature of the device is that the bolt can be tensioned to within plus or minus 0.0004 inch. The electric indicator is accurate to within 0.0002 inch. Other considerations, however, magnify the error which is still well within the allowable limits.

Controls: Among the salient features of the machine are the multiple checks provided to guard against over or undertorquing the bolt. The machine has three operator control panels. On each panel are three pilot lights, one each for "low limit torque reached," "torque reached" and "torque exceeded."

The first and third are green and red, respectively, and are operated by the electric dial indicator. The "torque reached" light is red, and is operated by an interlocking pressure switch on the torque motor line. The pressure switch, adjusted to trip between the limits of the electric dial indicator, stops the torquing operation at the nominal torquing value.

In operation the green "low limit torque reached" light is energized first, and almost simultaneously the red "torque reached" light is energized also. If the torquing continues after the light indicates torque reached the torque exceeded circuit lights the second red lamp and stops torquing at the upper limit.

In addition to this interlock, a pressure gage in front of the operator is provided for each torque motor, so that a visual check can be made from time to time of the exact pressure at which the "torque reached" light is being energized.

The danger of overtorquing the bolt is diminished, therefore, by three safety devices plus a visual check. The machine also provides a check on the quality of the bolt threads and the location of the cross-hole.

Control of the sequence of operations is largely manual because every operation of the machine requires observation by the operator. Since he must take up a new position on the machine for each succeeding operation, he is provided with three control panels. Each panel is conveniently located so that his hand rests on the control buttons while observing the machine cycles. All start and stop buttons are interlocked between all three stations so that an emergency does not require him to rush to a remotely placed pushbutton.

Electric and hydraulic controls are mounted in separate cabinets on the back of the machine, *Fig.* 12. These panels control the hydraulic power circuits shown schematically in *Fig.* 13 for operating the five components in the machine. These circuits and their representation conform to JIC standards.

As indicated previously, most machine functions are initiated by pushbutton. With the pump motor energized, the operator presses the pushbutton which energizes solenoid *C* in valve 11, admitting oil pressure to the head of cylinder 1 in the center head. This positions a pivoted arm in place and trips limit switch 9, energizing solenoid *Z* in valve 22 which operates cylinder 2 and places the shot pin to lock the pivot arm. After the center head is loaded, pushbutton energization of solenoid *A* in valve 10 clamps the crankshaft part in place with cylinder 3.

With the left head loaded, the operator energizes

solenoid *S* in valve 19, clamping the part and tripping limit switch 5. After loading the front master rod assembly, solenoid *V* in valve 20 is energized admitting oil to the head of cylinder 5 to slide the front assembly onto the center assembly. At the end of this travel, limit switch 2 is tripped. Through a time delay relay, energizing solenoid *W* in valve 21, it locks the left side in place and, through the action of cylinder 6, limit switch 3 is tripped. After another time delay this switch energizes solenoid *U* in valve 20 to operate cylinder 5, setting the left side backlash.

With the front crank cheek bolt in place, the bolt-stretch indicator inserted in the bolt and its dial set to zero, the operator energizes solenoid *N* of air valve 16. This lowers the spline socket and energizes solenoid *O* in hydraulic valve 17 to operate the right-hand torque motor. When the proper torque is reached, limit switch 17 stops the torque unit. The pressure switch in the hydraulic line is a safety switch to assure torque control. When limit switch 6 is tripped, a time-delay relay controls the reversal of the torque motor which, when the socket load is removed, returns to position.

Similar circuits, as shown in *Fig.* 13, release the crank holding the center crankshaft, remove the shot pin and lower the pivot support arm. After placing the center crankcase on the center main bearing, positioning the rear master rod and locating the rear crankshaft assembly in the right head, the operator energizes solenoid *I* of valve 14, which admits oil to the head end of cylinder 7, clamping the rear crankshaft into place. When oil is admitted into cylinder 8 through valve 13, the rear assembly slides onto the center assembly.

At the end of travel, limit switch 11 is tripped which, after a time delay, operates cylinder 9 through valve 12. This locks the right side in place and trips limit switch 10. Then oil is admitted to cylinder 8 after a time delay, setting the right side to a controlled backlash value. The crankcheek bolt is placed and tensioned with the right torque unit in a manner similar to that described for the left unit. Then the various clamping cylinders are operated to unclamp and the right head is retracted to initial position.

Parts Supply: Handling of component parts is

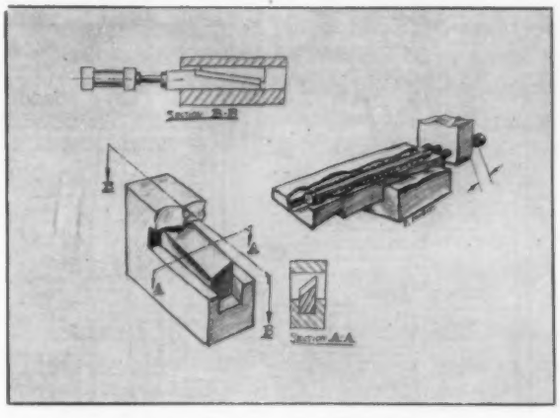
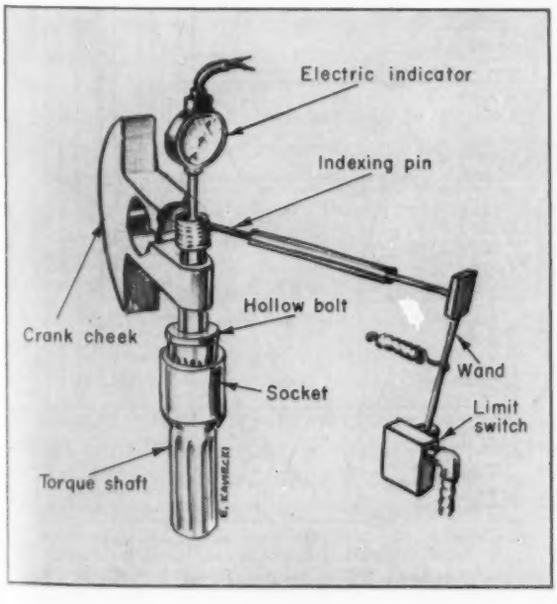
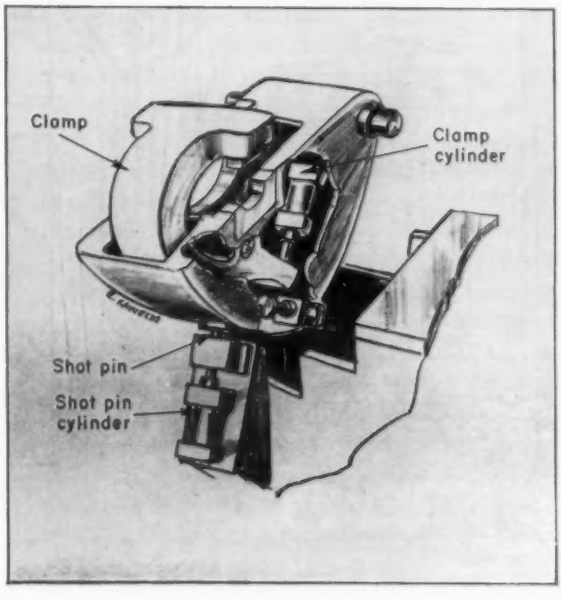


Fig. 9. Bottom left. Design detail of torque indicating pin unit. When hole in bolt and crank cheek yoke align, the pin enters the bolt. A wand following the pin trips the limit switch and stops the motor. This is one of the three torque checks employed.

Fig. 10. Top Right. Exact clearance for backlash between rod assembly hub and crankshaft is provided with this positive lock-out device.

Fig. 11. Bottom Right. Cradle arm detail for clamp in the middle head. When in clamping position, the shot pin locates the cradle in alignment with the other two heads. For assembly of center crankcase, the cradle rocks out of position for clearance.



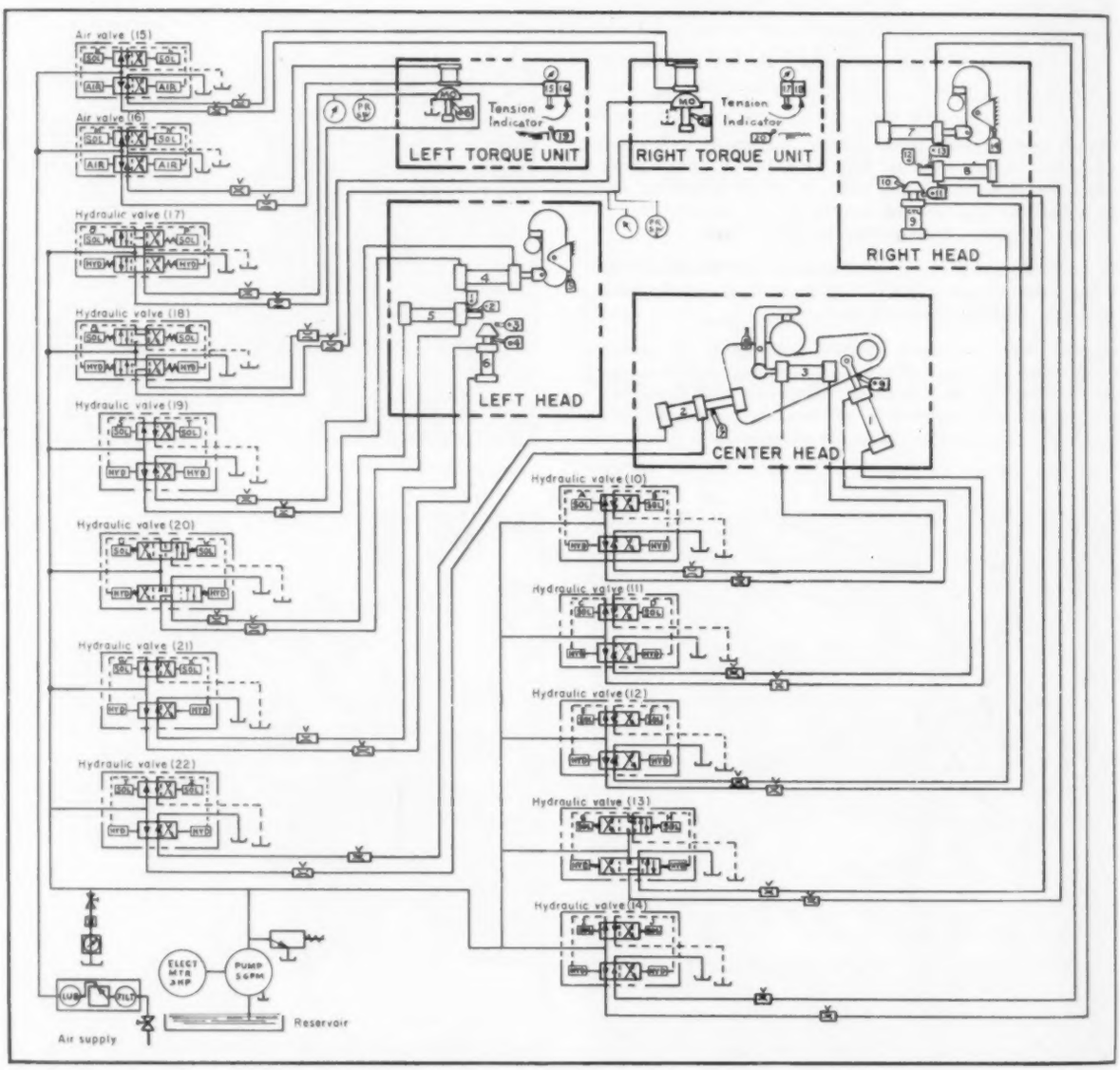


accomplished entirely by monorail. In order to load his parts, the operator simply lowers them into place with an electric hoist. The finished assembly is likewise lifted out, and is sent on its way to a succeeding operation.

Tests conducted by the machine manufacturer indicates that this machine can assemble crankshafts in about 4 percent of the time required for manual assembly. In addition, one operator, who may be trained in three days, can achieve this production whereas as many as three highly skilled operators are required for manual assembly. Further, the machine will not produce a defective assembly because automatic quality control is obtained through the checks and interlocks in the control system.

Fig. 12. Top. Hydraulic and electric control panels are mounted on back of machine and are laid out to facilitate maintenance.

Fig. 13. Bottom. Schematic diagram of hydraulic and pneumatic circuits for operating the five component parts of the machine.



Replacement Formulas— Are They a Help or Headache?

By Henry D. Sharpe, Jr.

President
Browne & Sharpe Mfg. Co.
Providence, R. I.

For several years following college, Henry Dexter Sharpe, Jr. worked in the Brown & Sharpe Mfg. Co. to acquaint himself with details of production and operations and to prepare for the responsibilities of management.

Mr. Sharpe is secretary of the Council for Technological Advancement, an organization formed by and integrated with Machinery and Allied Products Institute for the purpose of advancing American technology. He is a member of the Government Relations Committee of the National Machine Tool Builders Association.

OUR TECHNOLOGY is not only advancing but is progressing at a geometrically increasing rate of speed. This "improvement in improvement" is causing an increasingly serious problem for those charged with equipment policy. Little wonder that scientific reanalysis is attracting more attention today than ever before.

Three common methods are now in use by industry for gaging whether or not capital equipment should be replaced by more modern challengers. Basically speaking, these three methods can be distinguished as follows:

1. Analysis by arbitrary rules based on physical age.
2. Analysis by an arbitrary "years to payoff".
3. Analysis by the much talked of but seldom clearly understood MAPI formula.

Let us look for a moment at the way in which these three rules are being applied.

Age Retirement: Since a display of "young" equipment in a plant is said to be a traditional mark of good management, the simple age requirement has found popularity as a rule-of-thumb replacement formula in industry. There are, however, some interesting conflicts of judgment which appear when this replacement formula is surveyed in action.

For example, many plants of high profitability methodically retire equipment after five years of service. Many other plants, equally profitable, have rigid rules retiring equipment after ten years of service. Between these two popular patterns, there seems to be an opinion, at least in the screw products industry, that for some reason seven years is "the right length of time" for replacements.

Apparently, arbitrary retirement of machinery and equipment after a specified number of years is a widespread habit. but exactly what time is right for replacement under this method of attack is anybody's guess.

Pay-off Requirement: This brings us to our second major approach to equipment analysis, the "years to pay off" philosophy. Using this method, the plant manager insists that new equipment shall "pay for itself" out of savings in a certain stipulated number of years. Often the formula is stated in its opposite form, i.e., a certain rate of return must be demanded for a piece of new equipment.

Probably these two approaches share the spotlight as the most popular methods of solving equipment problems, yet they lay themselves open to several theoretical questions. The most insistent of these questions asks, "On what basis do you determine the number of years during which a machine must pay for itself?" Why should one company insist on a two-year pay-off while another company with equally good management insists on four-year pay-off? Again, there appears to be no scientific answer to this question.

From a talk at Hartford Night, June 8, 1953, sponsored by the Hartford ASTE chapter.

Another theoretical question raised by the pay-off system is, "Does an arbitrarily short pay-off requirement tend to shield the retirement of ancient equipment?" No one ever heard of a company purposely buying ancient equipment to justify the purchase of new equipment on the savings garnered by retiring the old equipment. Yet today, our plants are filled with many prehistoric relics only awaiting the day when they shall become so ancient as to finally pay for themselves.

MAPI Formula: These theoretical objections, and many more, have led to research on the part of the Machinery & Allied Products Institue and the formulation by Dr. Terborgh of a most interesting and basically novel approach to this old replacement problem. In the trade it is known as the MAPI formula and it constitutes the third major method of equipment analysis being used in the United States at the present time.

Briefly stated, the MAPI formula seeks to compare the average operating and capital costs of an old machine with the average operating and capital costs of a new machine. The formula is so arranged that it does not demand payoff within any fixed limits of time such as is arbitrarily set under the previous formulas. The MAPI formula seeks only to replace the equipment when the total cost of keeping it becomes greater than the total annual cost of replacing it.

Despite the practical resistance which the MAPI formula has met because of its theoretical completeness and complexity, this formula stands today as probably the closest thing there is to a scientific analysis of the economic facts of replacement.*

Practical Policy: Now, "What should the practical shop man do about exploring the advantages of being more systematic in his equipment policy?" Here are three practical suggestions distilled from our own experience. In making these suggestions, incidentally, we are in midstream and, as time goes on, we are developing new concepts of the proper procedure.

KEEP INFORMED ON DEVELOPMENTS: Spend plenty of time educating yourself and your staff about what is going on in replacement policy. There are many sources of material from which you can learn more, such as articles published in technical magazines. Also The National Machine Tool Builders Association has within four years produced two pamphlets on the subject. In addition, your municipal library may be able to supply you with some stimulating thoughts in this direction if you are of a thoughtful turn of mind.

The Machinery & Allied Products Institute has written many fine works about replacement policy, starting with George Terborgh's monumental book "Dynamic Equipment Policy," and amplifying the subject through such other publications as "Replacement Manual" (a digest of "Dynamic Equipment Policy"), and the MAPI "Procedural Manual" (a book outlining the specific organizational steps to be taken to install a more dynamic equipment policy). In addition to these publications MAPI has just backed the founding of a new department at Illinois Institute of Technology specifically dedicated to the study of replacement economics. Graduates of this course should soon be available for employment in our plants.

USE MAJOR SURGERY: As a practical rule, consider the "major surgery" approach and shun "knickknack" replacement programs. In our plant, it is extremely sitmulating to place the major emphasis of our replacement policy on improving product groups rather than on the random replacement of equipment in the shop.

This has many desirable effects. It achieves a maximum concentration of brains and interest on the problem at hand. It affords many opportunities for enthusiastic coordination between product design, methods and time study. It gives a real appraisal of materials flow and space utilization considerations. Such large-scale replacement programs enable us to conduct machinery capability tests to determine just how much production can be obtained from new equipment we hope to buy in quantity for a new layout. Also and not to be underrated, is the morale effect of a thoroughgoing and sweeping change in a concentrated area. Nothing succeeds like success. All these considerations are making the major surgery approach to replacement analysis justify the effort to our company.

BELIEVE IN SCIENTIFIC REPLACEMENT: As a final practical recommendation, keep this in mind. Equipment analysis is still an open field, and it needs your thinking cap. Keep your conviction that there is something more worthy than guesswork and superstition to solve this sticky question.

It would hardly be worth urging this last thought with such insistence were it not for the enormous national defense significance of replacement policy. Since basic economic strength almost more than any other factor weighs heavily in the scales of international intrigue, it is important that our mills and factories produce at the maximum possible rate at all times.

For this reason alone, even if no mention were made of the potential benefits which might accrue to your own company, this subject of replacement policy deserves your best brains.

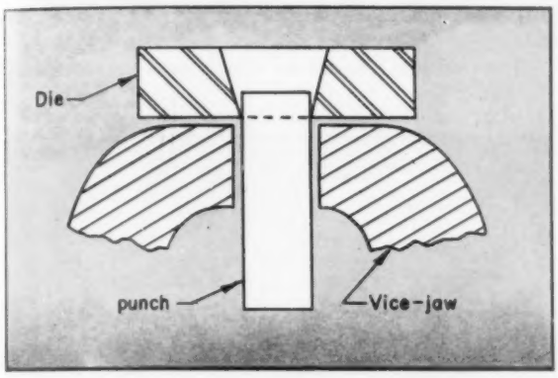
*"Machinery Replacement—How Costs Are Determined"—E. C. Varnum, THE TOOL ENGINEER, June, 1953

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Aid for Die Makers

In diemaking, punches often must be adjusted to the corresponding die openings or die openings adjusted to the respective punches. In both cases the toolmaker forces the punch into the die a little. After removing it, he makes the necessary adjustments on the punch or die.



His problem is to push the punch out of the die in such a way as to avoid the danger of its turning sidewise causing more or less serious damage to the die. This can be accomplished by putting the inverted die upon the jaws of the vise so that there is only sufficient opening to permit a sliding fit for the punch. In this way, the die maker will be sure that the punch will be pushed out of the die perpendicularly.

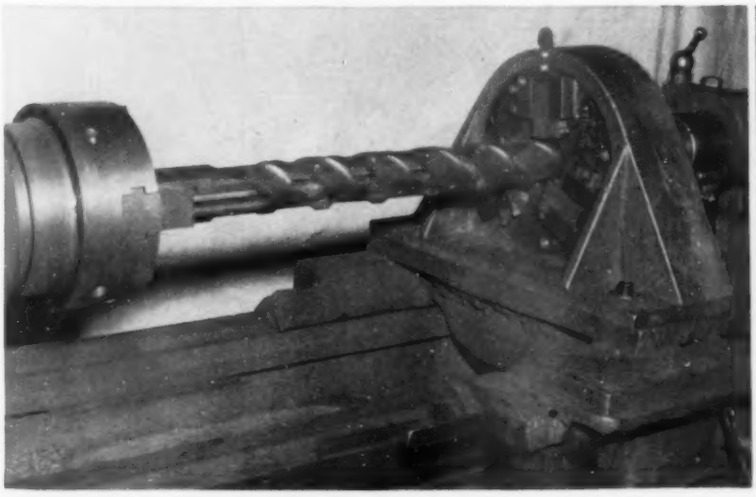
Federico Strasser
Santiago de Chile

Cathead Standardized with Inserts

Machining 50-inch by three-inch snapping rolls for corn harvesters requires a special setup using a cathead. As shown in the photograph, the work is done on a lathe fitted with a special holder for the cathead on the carriage. Covering almost the entire length of the casting, this turning operation is difficult because the multiple notched 4-inch pitch spiral requires severe interrupted cutting. The tool previously used contained a special set of nine brazed blades which produced approximately 50 pieces per grind. Two to three blades of a set had to be replaced because of breakage. When replaced, the head had to be disassembled. To assemble it again required setting with plug and feeler gages, consuming six to eight man hours.

The cathead was redesigned to adapt to three standard insert toolholders with standard solid round carbide inserts, which can be indexed four times, turned end for end and indexed four more times. To replace the inserts, the head need not be disassembled. Only 15 to 20 minutes is required for resharpening the set of inserts. Now 400 pieces are produced per index and with six to eight indexes, 2400 to 3200 pieces are produced per grind. Thus a considerable saving was effected through longer tool life, easier and faster tool changing as well as the sizable reduction in original tooling cost.

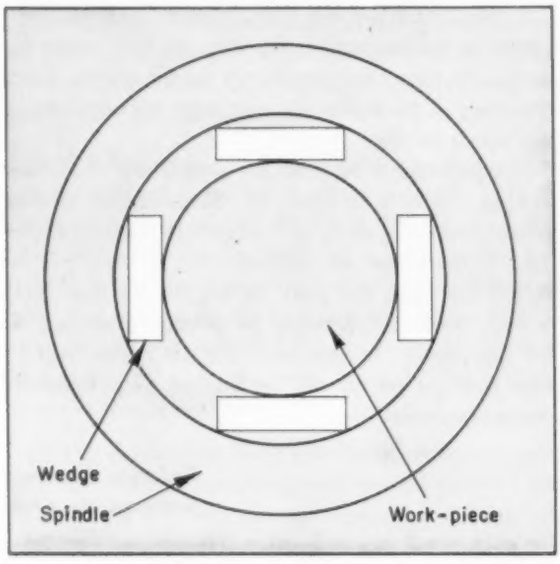
Frank Rozek
Davenport, Iowa



Cathead

Lathe Work Holder

Turning a bar nearly equal to the internal diameter of the hollow headstock spindle and of considerable length poses a problem. The chuck jaws cannot hold the heavy piece adequately and the



work stands which supports that part of the bar extending past the machine are of little help.

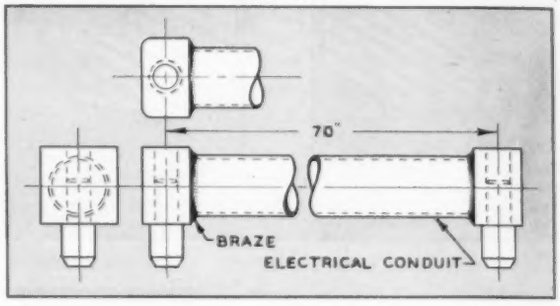
For such cases some small wooden wedges will turn the trick. Insert them firmly between spindle and work so that it is held rigidly centered and will not move or vibrate during the operation.

Federico Strasser
Santiago de Chile

Lightweight Length Gage

A gage was needed to check two pierced holes in a large sheet metal part. Since the holes were single punched, trouble was encountered in assembly because the holes were off between centers sometimes as much as ½ inch. Although a high degree of accuracy was not required, the hole spacing had to be held to at least plus or minus 1/16 inch. Since the distance between holes was almost six feet, the press operator was obviously unable to check the parts with a heavy, cumbersome gage all day.

The problem was solved simply and inexpensively



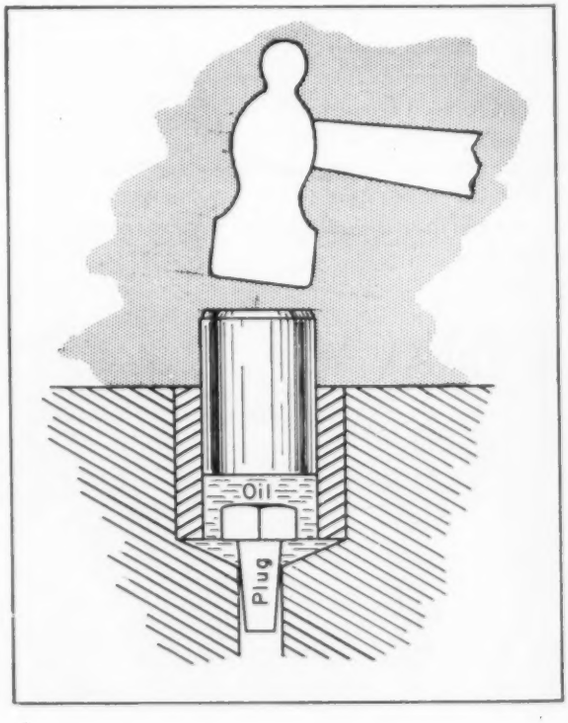
by taking a length of ¾-inch electrical conduit which is light in weight but rigid enough for the purpose. Two small blocks of cold-rolled steel were brazed on each end and two gaging pins pressed in.

Roger Isetts
Kenosha, Wis.

Bushing Puller

An old standby method for removing a bushing from a blind hole makes use of the hydraulic ram principle, and is simple yet effective. The bottom of the hole is plugged and the bushing partially filled with oil. A close-fitting dowel pin, or short piece of drill rod is inserted in the top of the bushing as shown in the accompanying illustration. A sharp tap with a hammer provides the hydraulic pressure needed to force out the bushing. As a precaution, it is desirable to wrap a piece of cloth around the bushing to act as a stopper for the geyser of oil that erupts with the hammer blow.

H. L. Blood
Worcester, Mass.



Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Payment for accepted articles is made upon publication.

How to Determine

Exact Blank Diameters

By Hjalmar Dahl

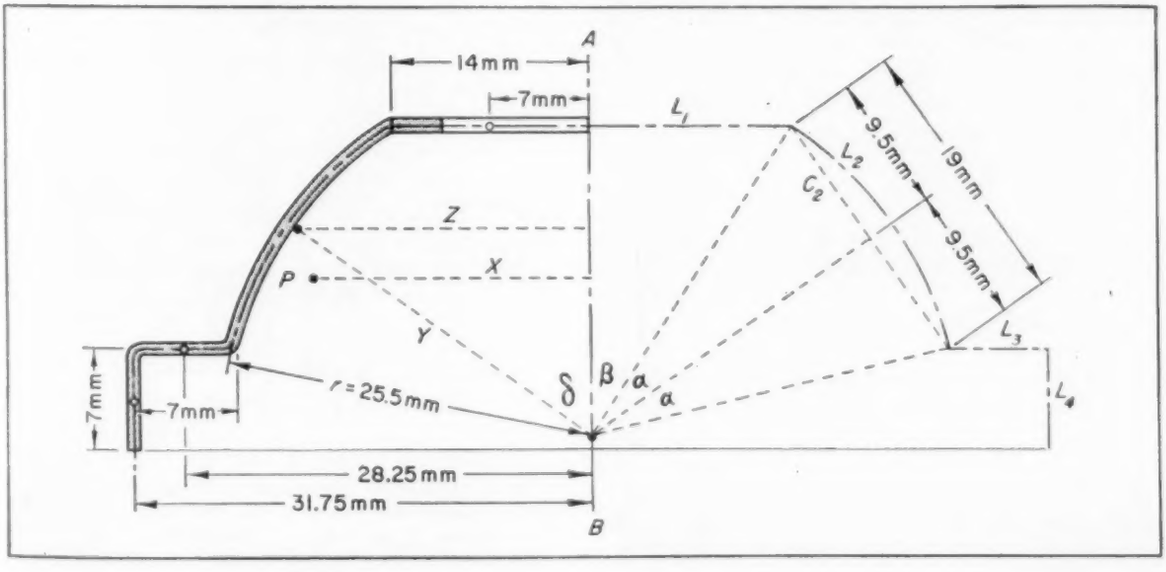
Husgvorna Arms Manufacturing Co.
Sweden

CHANGING FROM an unsatisfactory four-operation limited production method to a more economical single progressive operation hinged on accurately determining the exact blank diameter for a symmetrical drawn cup, and designing a one-stroke combination die set. The part, *Fig.* 1, was to be blanked and drawn from 0.020-inch stock and then pierced.

Determining the exact blank size that will produce such parts without trimming steps is difficult by ordinary methods. In this instance, the circular blank diameter can be calculated with a seldom-used rule of Gludinus. With this rule, the area of any surface of revolution can be found. The rule states that the area is equal to the length of the profile times the length of the path of its center of gravity. With the area known, it is a simple matter to calculate the diameter of the circular blank required.

The area of the surface swept out by revolving

Fig. 1. Diagram of the part indicating the method by which the exact blank diameter can be determined so that no trim step is required in its production.



lines L_1, L_3 and L_4, and arc L_2, *Fig.* 1, about axis *A-B* equals the lengths of the lines mutliplied by the path length of the center of gravity, *P*. Lengths of lines L_1, L_3 and L_4 (taken along the neutral axis) are known, with locations of their centers of gravity known in relation to axis *A-B*. Arc length L_2 and the position of its center of gravity with respect to axis *A-B* are unknown.

Begin by finding the angle 2α.

$$\text{Sin}\,\alpha = \frac{9.5}{25.5} = 0.3725$$

$$\alpha = 21°52' \text{ and } 2\alpha = 43°44'$$

$$\text{Length of circular arc } L_a = \frac{2\alpha}{360}\, 2\pi r$$

where r is the radius of the circular arc

$$L_a = \frac{43.75}{360} \times 2 \times 3.14 \times 25.5 = 19.32 \text{ mm}$$

The center of gravity of arc L_2 is located on the line that bisects the arc at a distance y from the center of the circle, or, where the chord length equals c_2,

$$Y = \frac{C_2 r}{L_a} = \frac{19 \times 25.5}{19.32} = 25 \text{ mm}$$

$$\text{Sin}\,\beta = \frac{14}{25.5} = 0.549$$

$$\beta = 33°20'$$

$$\delta = \alpha + \beta = 55°12'$$

The horizontal distance between axis *A-B* and the center of gravity of arc L_2 is represented as *Z*, and

$$Z = Y \sin\delta = 25 \times 0.82115 = 20.5 \text{ mm}$$

Moment Principle Used

To find the combined center of gravity for lines L_1, L_3 and L_4, and arc L_2, use the rule that the moments of each and every part of a line (or an area) when added together equal the moment of the entire system when referred to the same axis. Thus, if x represents the horizontal distance between axis *A-B* and the combined center of gravity, *P*, then:

$$(L_1 + L_2 + L_3 + L_4)\,X = L_1 \times 7 + L_2 \times Z + L_3 \times 28.25 + L_4 \times 31.75$$

$$47.32\,X = 14 \times 7 + 19.32 \times 20.5 + 7 \times 28.25 + 7 \times 31.75$$

$$X = \frac{914.06}{47.32} = 19.3 \text{ mm}$$

With the preliminary calculations completed, the rule of Guldinus can be applied.

Length of the system of lines = 47.32 mm
Length of path followed by $P = 2\pi \times 19.3$

Since the area is unimportant, the desired blank diameter, *d*, can be solved for directly.

$$47.32 \times 2\pi \times 19.3 = \frac{\pi d^2}{4}$$

$$d = \sqrt{4 \times 47.32 \times 2\pi \times 19.3} = 85.47 \text{ mm}$$

With the blank diameter known, it was possible to proceed with the design of the combination blanking, drawing and piercing die set, *Fig.* 2. The correct size of the piercing punch had to be determined by trial and error, because, due to tensile stretching of the material, the metal flowed outward from the hole and enlarged it. By trying progressively larger pierce punches and grinding the hole in the die to fit the punch after each test run, the desired size of hole was achieved. The material flowed out around it cleanly and without leaving a lip.

Punch Blanks and Forms

Operation of this combination die produces the cupped part in one progressive operation. Strip stock is fed across the face of the blanking die and is punched and formed by the combination blanking and forming punch. About 1/16 inch above bottom dead center, the piercing punch removes the unwanted material at the bottom of the cup. The ring prevents wrinkling during drawing, and strips the cup from the drawing die on the upstroke.

The cup is stripped from the blanking and forming punch by the stripper which is backed up conventionally. The stripper plate ring strips the stock material from the blanking punch on the upstroke. When acting as the blank holder, the ring is supported by four steel pins resting on the pressure plate over the air chamber.

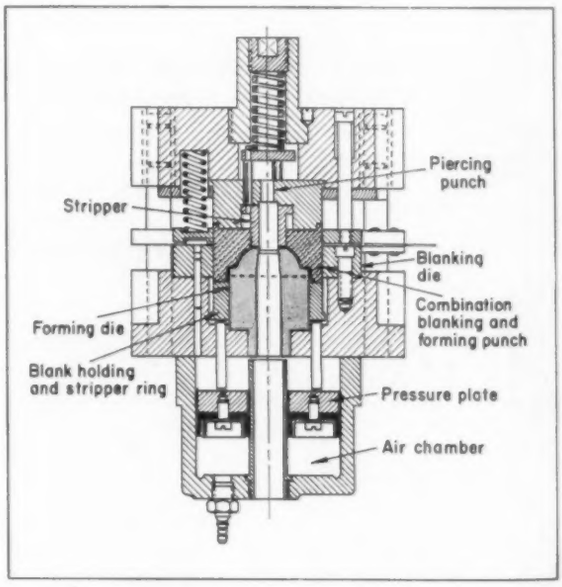


Fig. 2. Shown in the closed position with the workpiece completely formed, this one-stroke progressive die set does a job originally handled in four separate operations in conventional progressive dies.

GAGE AND TOOL CONTROL for Multi-plant Operation

By Thomas J. Bizzoco*

Arma Corporation
Brooklyn, New York

THE PAST DECADE has brought about changes in the physical structure of manufacturing plants. Great production centers have evolved into small, centralized units, making necessary an efficient method of tool dispersing. These individual branches are developing independent means for controlling and distributing jigs, fixtures, gages and precision instruments. Tool and gage control has become an important phase of a multi-plant setup for the regulation of (1) unwarranted tool rejects, (2) material waste, (3) interchangeability and (4) tool losses.

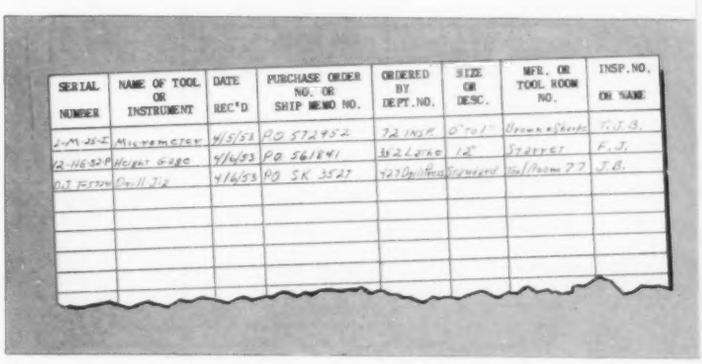
Plants using large numbers of jigs, fixtures, gages, and precision instruments need a simple yet efficient handling system. Many systems are available that can be established for a nominal sum, but will they suit the average shop's setup?

Discussed below is one workable system which involves the use of a conveniently located tool and gage laboratory. This area is air-conditioned and equipped with the latest precision measuring instruments. Storage space is large enough to accommodate tools, jigs, fixtures, dies, plain and thread gages, inspection fixtures, precision measuring instruments, special tools and gages, filing cabinets for part prints, and tooling for future jobs. A section of the laboratory is divided by glass panels into areas for tool repair and simple inspection-fixture building.

It would be good practice to instruct the receiving department to deliver new tools, gages and precision measuring instruments to the central tool and gage laboratory for accuracy inspection before acceptance. Upon receipt, the gage inspector immediately unpacks and degreases the new item. After satisfying all inspection requirements, the new tool is catalogued, and numbered for identification. A log book, *Fig.* 1, is kept for accepted items. Information is entered by the tool and gage inspector. The log can be used to quickly locate a tool, find its date of purchase and other data.

After entering all the facts in the log book, the

Fig. 1. After a new tool has been accepted by the inspection department, detailed information concerning it is recorded in a log book.

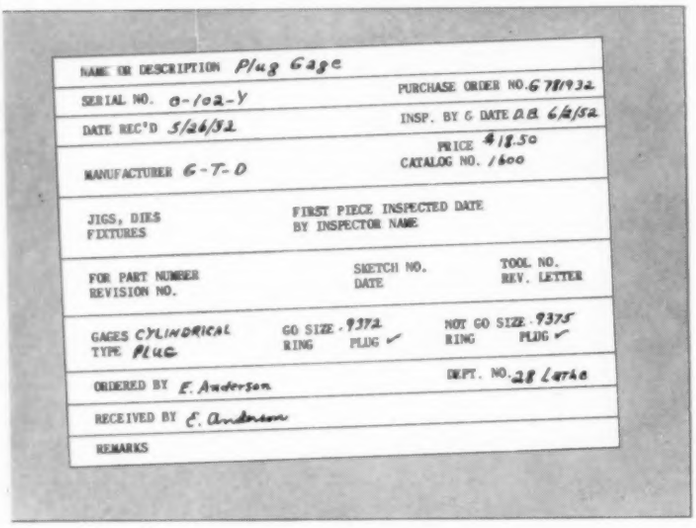


SERIAL NUMBER	NAME OF TOOL OR INSTRUMENT	DATE REC'D	PURCHASE ORDER NO. OR SHIP MEMO NO.	ORDERED BY DEPT. NO.	SIZE OR DESC.	MFR. OR TOOL ROOM NO.	INSP. NO. OR NAME
2-M-35-E	Micrometer	4/5/53	PO 572952	72 INSP	0"to1"	Brown&Sharpe	T.J.B.
42-116-52-P	Height Gage	4/6/53	PO 561841	362 Lab	12"	Starrett	F.J.
0J FETTU	Drill Jig	4/16/53	PO SK 3527	727 Drill Press	Engraved	Tool Room 77	J.B.

*Senior member ASTE Greater New York Chapter.

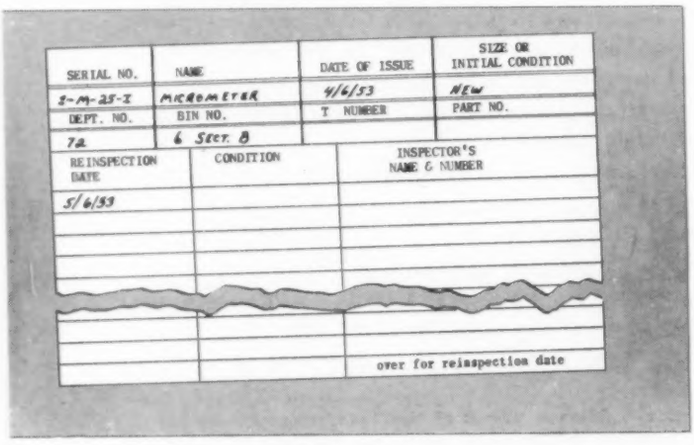
inspector completes a master file card, *Fig.* 2. Having done this, he fills out a crib file card, *Fig.* 3, for use by the crib attendant. The department foreman should sign the master file card, which is then promptly returned to the central tool and gage laboratory. The tool and crib card are then placed in the tool crib. The crib's location is noted on the crib card prior to filing. There are three file drawers in each crib; one each for tools, gages, and measuring instruments. It is best to separate the file cards into general classifications, such as fixtures, gages an measuring tools to expedite the issuance of tools.

Fig. 2. A master file card is filled out by the inspector and signed by the department foreman concerned. The card identifies and records the gage, fixture or measuring instrument for future reference.



NAME OR DESCRIPTION Plug Gage	
SERIAL NO. 0-102-Y	PURCHASE ORDER NO. G 78/932
DATE REC'D 5/26/52	INSP. BY & DATE D.B. 6/2/52
MANUFACTURER G-T-D	PRICE 418.50 CATALOG NO. 1600
JIGS, DIES FIXTURES	FIRST PIECE INSPECTED DATE BY INSPECTOR NAME
FOR PART NUMBER REVISION NO.	SKETCH NO. DATE / TOOL NO. REV. LETTER
GAGES CYLINDRICAL TYPE PLUG	GO SIZE .9372 RING PLUG ✓ / NOT GO SIZE .9375 RING PLUG ✓
ORDERED BY E. Anderson	DEPT. NO. 28 Lathe
RECEIVED BY E. Anderson	
REMARKS	

Fig. 3. By referring to the crib file card the attendant is able to note locations and reinspection dates for tools in his possession.



SERIAL NO.	NAME	DATE OF ISSUE	SIZE OR INITIAL CONDITION
1-M-25-I	MICROMETER	4/6/53	NEW
DEPT. NO.	BIN NO.	T NUMBER	PART NO.
72	6 SECT. B		

REINSPECTION DATE	CONDITION	INSPECTOR'S NAME & NUMBER
5/6/53		
		over for reinspection date

NAME	TIME LAPSE FOR REINSPECTION	COLOR
PRIMARY SIZE BLOCKS	ONE MONTH	GREEN
SECONDARY SIZE BLOCKS	" "	"
HEIGHT GAGES	" "	"
MICROMETERS	" "	"
DIAL INDICATORS	" "	"
DRILL JIGS	THREE MONTHS	RED BRIGHT
LATHE FIX.	" "	"

All tools, gages and measuring instruments are coded numerically in a simplified manner. For example 1 M 25 I is broken down as follows: 1 represents 1-inch, M indicates micrometer, 25 shows the log number, and I represents ordered by inspection. Drill jigs, fixtures, dies and similar tools are identified by tool number, sketch number and/or part number. However, the initials, such as D. J. for drill jig, L. F. for lathe fixture, and F. D. for forming die, should appear before or after the tool number.

To illustrate the mechanics of this system, a micrometer will be taken through the cycle.

An operator requests a 1-inch micrometer from the tool crib attendant. The attendant removes from the measuring instrument file a card identified as serial number 1M25, the code for which was explained above. He issues the micrometer corresponding to this number and receives a tool check. The attendant clips the tool check to the file card, places it in the "out" file rack, and is ready to serve the next man. Total issuance time, 12.5 seconds. When the operator returns the micrometer, the attendant reads the serial number, writes the tool's condition on the file card, returns the tools to its proper place in the crib and refiles the card. Complex tool-inspection jobs, together with their cards are sent to the central gage laboratory, for inspection.

Reinspection dates for tools, gages and measuring instruments are governed by a color-code chart, *Fig.* 4. Plug, ring and thread gages are checked prior to use and do not require a color code. The color of the crib file card should correspond to that shown on the color-code chart. Gages and tools are not allowed to reach the production or inspection areas without the inspector's acceptance. Only gages with protective plastic coatings are permitted to enter the production or inspection departments.

It is not advisable to order tools, gages and instruments without consulting the central laboratory to make certain the item is in stock. An order, together with part prints showing dimension to be checked or holes to be drilled, cuts to be milled or forms to be made, is forwarded to the laboratory to be doubly sure the correct item is being requested. If a gage, tool or instrument is to be loaned to an-

Fig. 4. A color code chart assists the inspector and crib attendant in noting reinspection periods for tools.

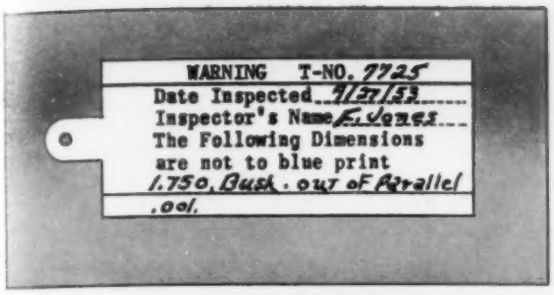


Fig. 5. This warning tag is attached to tools found to be no longer serviceable by the inspection department. Reasons for rejection are noted.

other department, the foreman should notify the area tool inspector. The inspector fills in two cards —one for the laboratory, the other to accompany the tool to its new location.

Production tools such as drills jigs, dies, fixtures, special taps, and forming tools are inspected as per tool sketch or blueprint. The tool and gage inspector checks the first piece made by these tools to ascertain workability and accuracy. If the tool is accepted, its cards, *Figs.* 2 and 3, are filed in the crib. A tag is attached to the tool indicating that it has been inspected. The same procedure is followed if the tool is acceptable to the production department but not acceptable to the inspection department, *Fig.* 5. In this event, the tool and gage inspector attaches a green tag which explains reasons for rejecting the tool. If the tool proves defective to both production and inspection, a red tag is attached to prevent the tool's use. A rejection report is made and copies sent to (1) inspection and quality control, (2) cost and estimating, and (3) vendor or the department responsible.

It is advisable to have gage inspectors fill out a daily activities report in duplicate to enable the central laboratory to determine the amounts and types of tools and gages to be replaced, *Fig.* 6. To control the quantities of new tools ordered, the central tool and gage department submits a quarterly report to the methods and scheduling division of all tools, gages and measuring instruments that have been received. Damaged tools are returned immediately with their history cards to the central laboratory. Tool damage is recorded in duplicate, *Fig.* 7, by the area tool and gage inspector involved.

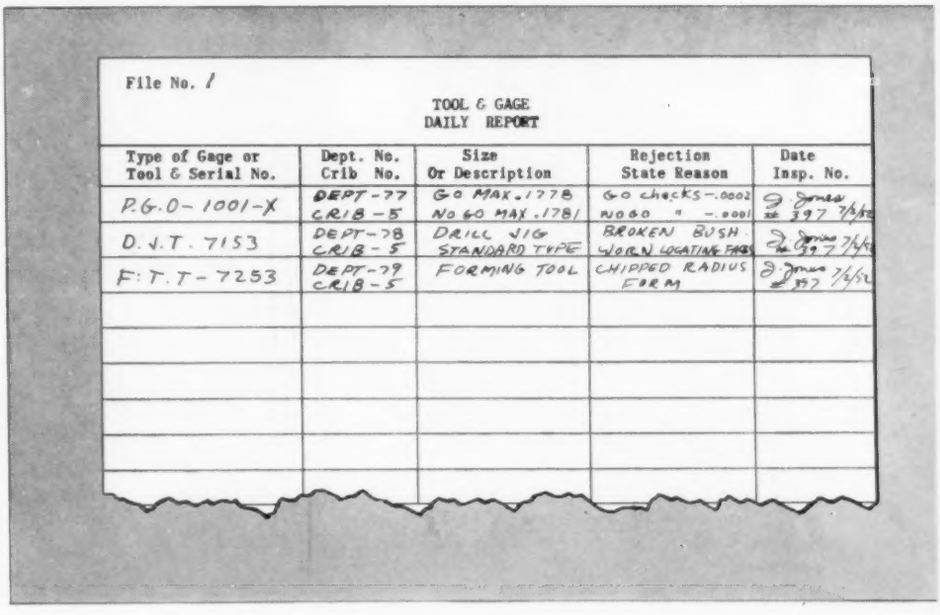
If the tool, gage or measuring instrument is damaged beyond repair, the master file card and crib card are removed from the active file and placed in a reject file. Notice is given the department from which the tool was removed that the item is no longer in use. If, however, the tool is returned to its original manufacturer for repair a copy of the repair order, accompanied by the master file and crib history, is placed in the repair file which is kept in the repair section of the central tool and gage laboratory.

A tool control system of this type, if coordinated properly, would be both effective and foolproof in its function. Such a method would result in increased and better quality production at a low cost.

Fig. 7. A tool damage report is kept by inspectors. If the tool is irreparable, the master file card and crib card are placed in the reject file.

TOOL DAMAGE REPORT

Name of Item DIAL INDICATOR From Dept. 77
Cause of Damage BROKEN DIAL Carelessness
Accidental ✓
Operator or Inspector's No. OPERATOR # 551
Serial No. D-I-12 Tool No. Sk No.
Dept. Foreman H. Anderson

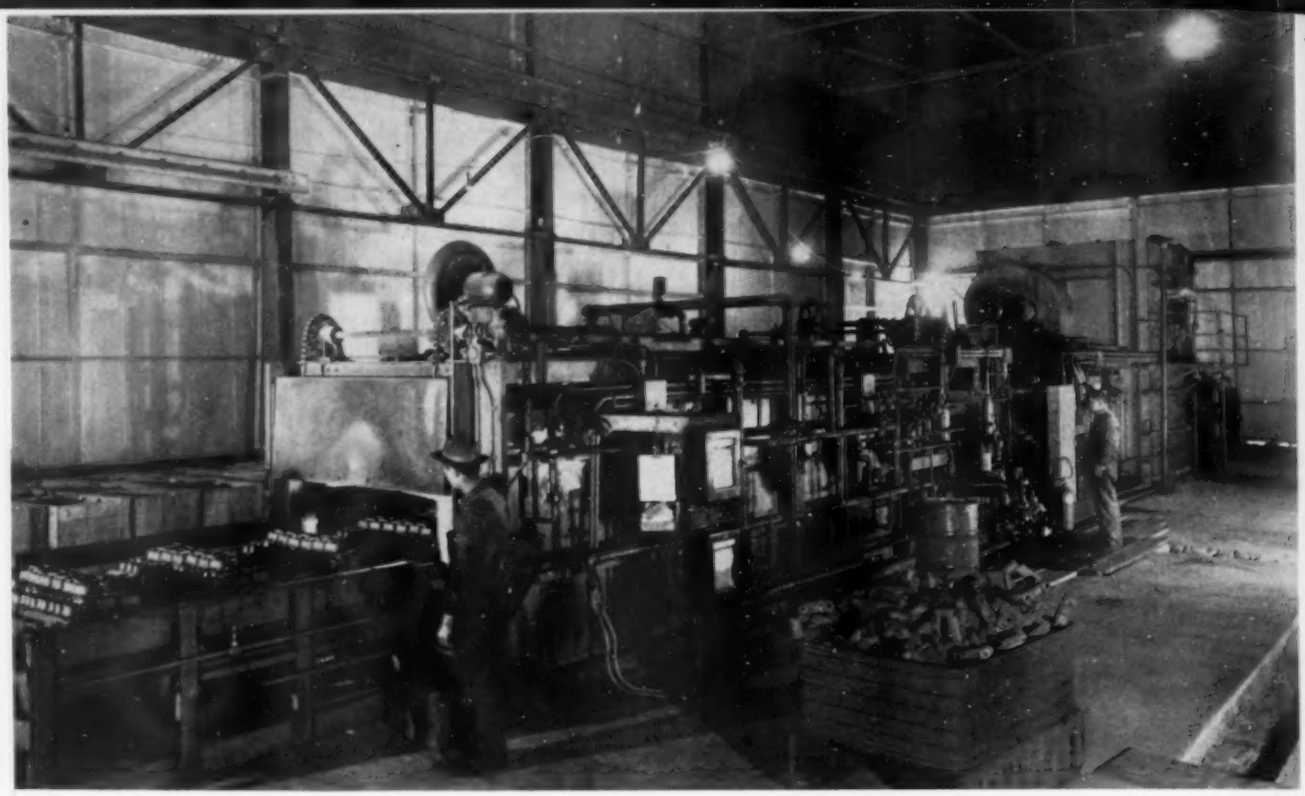


File No. 1

TOOL & GAGE
DAILY REPORT

Type of Gage or Tool & Serial No.	Dept. No. Crib No.	Size Or Description	Rejection State Reason	Date Insp. No.
P.G.O-1001-X	DEPT-77 CRIB-5	GO MAX. .1778 NO GO MAX .1781	GO checks -.0002 NOGO " -.0001	F. Jones #397 7/4/53
D.J.T. 7153	DEPT-78 CRIB-5	DRILL JIG STANDARD TYPE	BROKEN BUSH WORN LOCATING PADS	F. Jones #397 7/4/53
F.T.T-7253	DEPT-79 CRIB-5	FORMING TOOL	CHIPPED RADIUS FORM	F. Jones #397 7/4/53

Fig. 6. This inspector's report is used by the central laboratory to determine the number and description of tools needing replacement.



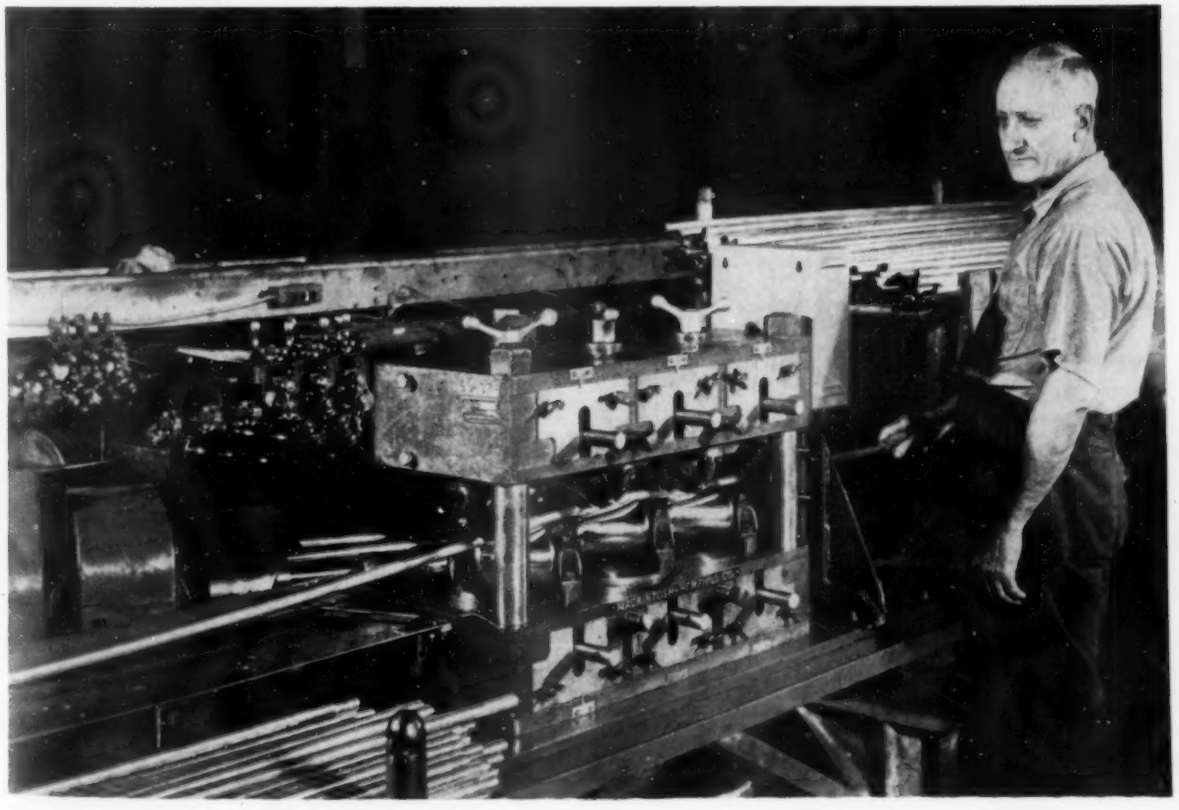
Above: Completely conveyorized through heating, quenching, cleaning and tempering chambers, with roller conveyor tray return to charge end enables this Holcroft furnace to attain a rate of 5000 pounds per hour at Modern Steel Treating Co., Chicago.

TOOLS at work

Right: Shipping hot ingots and billets in specially designed insulated containers between plants overcame several costly production delays for Heppenstall Co. Cooling ingots for shipment required as much as ten days previously, while reheating further delayed forgoing operations. The shipping containers are reinforced asbestos sandwiched in low gage sheet metal.

Above: **Automatic assembly of valve guide pins of cylinder head is accomplished in the Willys plants in Toledo by means of this press designed and built by Colonial Boach Co. The machine locates and positions the cylinder head in two stations in which the head is stamped and brushed, six pins inserted and the fit inspected. Pressure switches stop the machine, flash red light if undersize, green light if oversize.**

Below: **Seamless brass tubing is straightened on this Mackintosh-Hemphill machine with deviation of only 0.015 inch per foot at an Eastern tube mill. Because of the precision attained, no further manual straightening is required. The straightener also doctors ½ inch full hard aluminum tube out of round as much as 0.011 bringing it within plus or minus 0.001 inch by the time it reaches the run-out table.**



A Rational System of Limits

By F. W. M. Lee, M. I. Prod. E.

Managing Director
The Pilot Plug Gauge Co., Ltd.
Coventry, England

This recently designed system of limits is presented to show what can be done by a logical approach to a long-standing problem. Several points regarding the method by which this system could replace existing British and American limit systems are not fully covered, but the author has indicated that further study will prove that the differences in diameter step tolerance change points and a few of the tolerances can easily be settled. He further indicates that worn gages could be replaced with equivalent Pilot + 2 gages to give a quick changeover at no cost while maintaining interchangeability.

IT HAS BEEN APPARENT for a long time that a comprehensive limit system, one that could be used by all branches of engineering, would be particularly beneficial. It has been felt, however, that such a system must of necessity be both unwieldy and complicated. Many systems have been analyzed and superimposed on each other graphically to see if they had any common features. There were none and it was clear that any proposed system must be based on a new conception; a conception that would take into account modern requirements, and allow flexibility for both present and future refinements.

A prerequisite to setting up a new limit system conception is to determine the tolerances used in industry. The limits on 10,000 gages, recently manufactured by The Pilot Plug Gage Co., Ltd. and Messrs. John Harris (Tools) Ltd., Warwick, were analyzed. This investigation provided a wealth of information on the limits presently used in many different branches of engineering and was the basis for the new system.

One of the first considerations was to determine whether a new system of limits should be unilateral or bilateral. In a unilateral system, the hole is standard with the diameter of the shaft varied to give the required fit and in a bilateral, the shaft is standard with the hole varied to provide the fit. For production reasons it is easier to vary the diameter of a shaft and for this reason any new system should fall in the unilateral class. In support of this conclusion, it can be shown that the predominant tolerance systems are all unilateral.

The new Pilot + 2 system is unilateral. The smallest diameter of the hole is never less than the basic diameter and the tolerance is always in a plus direction. The largest diameter to which the hole may be made is greater than the basic diameter by the amount of the tolerance.

An ideal limit system should be simple. The Pilot + 2 system is so designed that any tolerance for any class or diameter of hole can be calculated mentally. The fundamentals of the system can be explained to a novice in a few minutes and the tolerances for the smaller holes—investigation indicated that 98.4 percent of all limited holes are below four inches in diameter—can be memorized.

The Pilot + 2 limit system is based on two cardinal points: (1) As the diameter of the hole increases, the tolerance also increases, and (2) as the class of the hole becomes coarser, the tolerance steps also become coarser. These points are met by the interplay of three factors used in calculating tolerances: (1) The + 2 of the Pilot + 2, (2) the class or quality of the hole and (3) the nominal diameter of the hole.

To calculate tolerances, add + 2 to the whole-inch diameter of the hole and multiply by the class number of the fit. This gives the tolerance in ten-thousandths of an inch. For a 1-inch diameter Class 2 hole, the calculation is: (1 + 2) 2= 0.0006 inch. For a 20-inch diameter Class 4 hole, the tolerance is (20 + 2)4 = 0.0088 inch. Conversely, if the known tolerance is divided by the whole-inch diameter plus two, the class number is determined.

For hole diameters of 0.125 inch and less, the

class number is the tolerance expressed in ten-thousandths. For holes larger than 0.125 inch but less than 1 inch in diameter, tolerances in ten-thousandths are obtained by multiplying 2 times the class number of the fit. For a 0.25-inch diameter Class 1 hole, the tolerance is 0.0002 inch. Tolerances for holes from 0 to 6 inches in diameter with fits from Class 1 through Class 6 are listed in TABLE 1. The table shows that for holes:

0.000—0.125 inch, the tolerance increases with class in steps of 0.0001 inch.
0.126—0.999 inch, the tolerance increases with class in steps of 0.0002 inch.
1.000—1.999 inch, the tolerance increases with class in steps of 0.0003 inch.
2.000—2.999 inch. the tolerance increases with class in steps of 0.0004 inch.

It should be noted that, apart from the modification of 0.125 inch and downward, which range is introduced for use by instrument, watch, clock and similar trades, values for tolerances change at nearly inch intervals. Fractional inch parts of diameters are ignored.

While TABLE 1 shows only six classes of tolerance, there is no theoretical limit to the number of classes provided by the limit system. Investigation has shown that industry already restricts the number of classes and that Classes 3, 4 and 5 are most used, depending on the manufacturer and the product.

When a manufacturer determines a range of classes of fit, he should bear in mind the type of product and should insist that no other classes of fit can be used without special permission from the design and production departments. In this way, limits that are unnecessarily tight and have no bearing on general design and production requirements will be avoided. There will be no chance of perpetuating tight tolerances with the consequent increase in production costs.

To be practical, a limit system must encompass the tolerances for shafts as well as for holes. The chart in *Fig.* 1 shows the complete layout of the Pilot + 2 system applied to both holes and shafts. It should be noted that class tolerance lines for shafts are provided below the basic line to exactly equal hole tolerance lines above the basic line.

Shaft tolerances are calculated in exactly the same manner as hole tolerances, so that an inversion of TABLE 1 would serve for shaft tolerances.

In conjunction with simplicity, ease of calculation and inclusiveness, an ideal limit system must also give a mental picture of fits. In the unilateral Pilot + 2 system, the smallest diameter of the hole is the dominating dimension, so it is the nominal or basic diameter of the hole that must be kept in mind when deciding on a fit.

As an example of determining the class of a shaft for a running fit, assume a 1-inch diameter hole is produced to its smallest size of exactly 1 inch and a shaft is to rotate in the hole with a clearance of at least 0.0003 inch but not more than 0.0006 inch. Reference to the class lines below the basic line for 1 inch diameters, in *Fig.* 1, indicates that such a shaft can be described by Classes 1 and 2. Class 1 represents a tolerance of 0.0003 inch below nominal size, and Class 2 a tolerance 0.0006 inch below nominal.

In the Pilot + 2 system, the nominal line is indicated in fit descriptions by means of an oblique stroke/, with plus tolerances to the left and minus tolerances to the right. Since the shaft of a running fit is less in diameter than the smallest or nominal size of hole, the composite class number describing the tolerance range of the shaft is placed to the right, or minus side of the oblique line.

Because the largest diameter of the hole in the system is controlled by the class number, or in other words the tolerance, the hole is perfectly described, in the case of a Class 1 hole by: 10/. The 0 is the nominal size irrespective of class or diameter. Only one number, the class number, is required to describe the hole since the other number is always zero and can be ignored.

The running fit is then written 1/12. of which the

Table I Pilot + 2 Tolerances for Holes (0.0001 inch)

	Class No.	0 But not 0.126"	0.126" But not 1"	1" But not 2"	2" But not 3"	3" But not 4"	4" But not 5"	5" But not 6"
	6	6	12	18	24	30	36	42
Black	5	5	10	15	20	25	30	35
Amber	4	4	8	12	16	20	24	28
Blue	3	3	6	9	12	15	18	21
Green	2	2	4	6	8	10	12	14
Red	1	1	2	3	4	5	6	7

first 1 is representative of the Class 1 hole, and the 12 represents a shaft that is a minimum of 0.0003 inch and a maximum of 0.0006 inch smaller than the nominal size, and therefore with the required clearance.

In a similar manner, a representative interference fit would be written 123/, where, the first number indicates a Class 1 hole and the 23 indicates a composite Class 2 and Class 3 shaft. In this instance, the shaft designators are to the left or plus side of the oblique line. This designation indicates the shaft is larger than the hole because the class numbers controlling the shaft size are numerically greater than the class number of the hole.

A selective assembly fit is written 110/, from which it is apparent that the hole and the shaft have the same tolerances and must therefore be matched. The fit of the hole described in the foregoing manner should be included in assembly or subassembly drawings, and the actual tolerances stated on the component drawings.

The system being essentially unilateral, would not be complete if it could not provide suitable tolerances for ball and roller bearing race housings. These housings require three types of holes: (1) Oversize, (2) transition or bilateral, and (3) undersize holes.

In oversize holes, the maximum permissible diameter and the minimum diameter of the hole are both larger than the nominal size of the ball race to be used. For bilateral holes, the maximum size is greater and the minimum size is less than the nominal diameter of the race. In undersize holes, both diameters are smaller than the nominal outside diameter of the ball race.

Since the smallest diameter of the oversize hole is larger than the basic diameter, the class number alone is not sufficient to describe the hole. Zero does not represent the minimum diameter. A number, which is a class number, is used to indicate by how much the smallest diameter is larger than the basic diameter. Thus, an oversize hole requires two numbers for its definition.

Since two numbers are used to describe a shaft in this system, a prefix *B* is used to designate bearing holes. If it is required to describe a bearing hole for 1½-inch outside diameter ball bearing with an easy sliding fit of + 0.0024 inch top limit and a + 0.0012 bottom limit, the descriptive classes can be remembered or calculated. The upper limit, 24 divided by 3, indicates Class 8, and 12 divided by 3 indicates Class 4. Because both are plus, they would be placed to the left of the oblique line. The bearing hole would be accurately described by *B* 2/1 and an undersize hole by *B*/14.

A salient feature of this system is the mental picture of the class of fit transmitted by the position of the class numbers relative to the oblique line. A cursory glance indicates the type of hole in the bearing housing and the fit between the

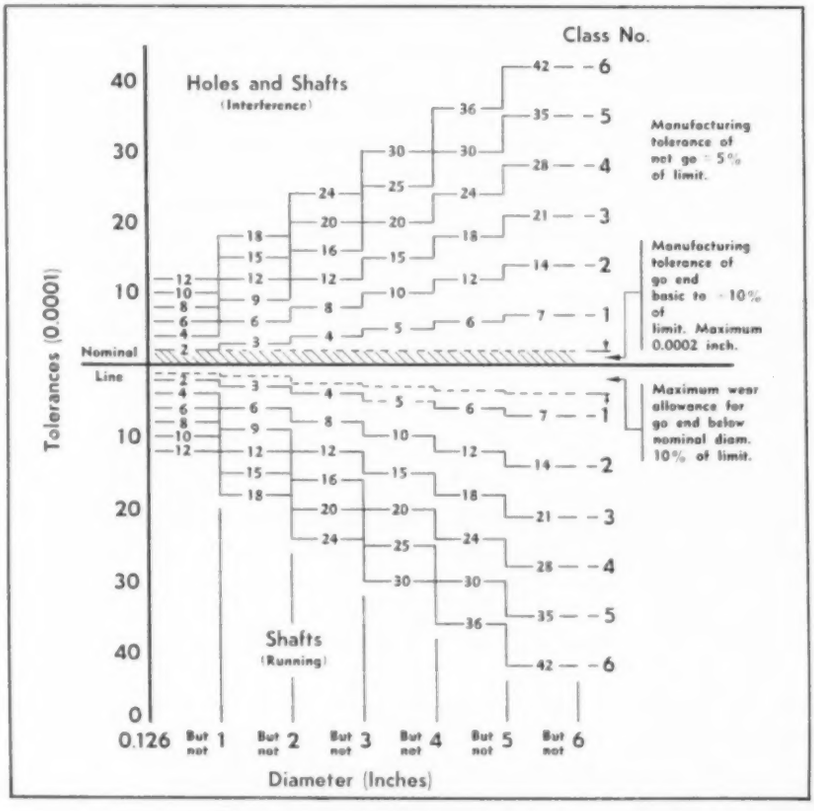


Fig. 1. This single chart gives all the tolerances for both holes and shafts in the Pilot + 2 system from 0.126 inch to 6 inches in diameter and indicates manufacturing tolerances for gages. Tolerances for holes smaller than 0.126 inch in diameter are shown in Table 1.

Table 2 Comparison of Tolerance Values (0.0001 inch)

American						Pilot + 2					
Above	0.029	0.825	1.510	2.510	4.510						
To and Including	0.829	1.510	2.510	4.510	6.510	Class No.	0.126" But not 1"	1" But not 2"	2" But not 3"	3" But not 4"	4" But not 5"
Z	10	12	16	20	25	4	8	12	16	20	24
Y	7	9	12	15	19	3	6	9	12	15	18
X	4	6	8	10	13	2	4	6	8	10	12
XX	2	3	4	5	6.5	1	2	3	4	5	6

bearing and its housing.

In the Pilot + 2 system, usual practices of allowing gage makers 10 percent of the limit as a manufacturing tolerance in a positive direction on the Go end, and allowing a manufacturing tolerance of 10 percent of the limit split on the Not Go end have been adopted.

Consider the manufacture of a nominal 1-inch diameter gage with a limit of 0.001 inch. Since 10 percent of the tolerance can be allowed in the manufacture of the Go end in the positive direction, the Go end can be a minimum size of exactly 1 inch, and a maximum size of 1.0001 inch.

The Not Go end has 10 percent of the tolerance split so that it can be 5 percent of the limit larger than its theoretical size of 1.001 inch, or 5 percent of the limit smaller than this size.

Gage makers attempt to make Go ends of gages to the largest size to provide maximum useful life for the gage, and attempt to make Not Go ends to the largest size so that the production department has the greatest possible tolerance to work with.

No mention has been made of "workshop" and "inspection" gages because they are considered correct in theory but impossible in practice. A new workshop Go end would be slightly larger than its inspection counterpart, but because of more severe conditions under which it is used it is soon smaller than the inspection gage. Frequent inspection of gages could minimize this condition but such inspection is rarely attained. With this in mind, and because sharing the tolerance between inspection and shop robs the operator, the system uses only one manufacturing tolerance.

Established practice is followed in that the wearable Go end will be allowed to wear 10 percent of the limit below the basic size before withdrawal from service. A 1-inch Class 1 gage with a limit of 0.0003 inch would be allowed to wear 0.00003 inch below the nominal diameter before withdrawing it from use. Since a certain amount of gage clearance is required under production conditions, a worn gage will indicate a hole that is right on size just before it is withdrawn from use.

To obtain maximum value from any new limit system it should be designed to substitute for either established British or American systems. If this can be done, interchaneability will be unaffected and gages of neither system need be scrapped.

American grades *XX*, *X*, *Y* and *Z* are designed to allow 10 percent of the limit in a plus direction on the Go end and split 10 percent on the Not Go end as manufacturing tolerances, as in the Pilot + 2 system, so that a tolerance table, TABLE 2, can be prepared.

There is a marked resemblance between the tolerance values used in these limit systems, but the diameter steps at which the tolerances change are at variance.

The similarities of the two systems are even more remarkable when considering only those holes which are 4 inches in diameter or less. Percentages of tolerance similarities and differences are tabulated below for the American and Pilot + 2 systems.

Grade	Differences		
	None (%)	0.0001 in. (%)	0.0002 in. (%)
XX	71.0	28.0	--
X	75.3	12.3	12.4
Y	63.2	36.8	0
Z	87.6	12.4	0

Exact equivalents for American tolerances are found to a high degree in the Pilot + 2 system as is shown in TABLE 3. In the cases where differences arise, their magnitude is small when compared with the total tolerances used and of no practical significance.

The replacement tables, TABLE 4, detail Pilot + 2 equivalents for American and British Standards Institution *U* tolerances. It can be seen that the Pilot + 2 system offers a connection between American and British practice.

As can be seen from the chart of *Fig.* 1, the upper manufacturing limit is restricted to a maximum of 0.0002 inch on the Go end of a gage. Reasons for this maximum figure are that it keeps gages within

Table 3
Tolerance Replacement Tables (0.0001 inch)

American						B.S.I.U.		
		Pilot + 2 Classes For						
Above	To and Including	XX	X	Y	Z	From	To	Pilot + 2 Class
.029	.125	2	4	7	10	0	.125	6
.125	.825	1	2	3	5	.126	.290	3
.825	.999	1	3	4	6	.300	.590	4
.999	1.510	1	2	3	4	.600	.999	5
1.510	1.999	1	3	4	5	1.000	1.490	4
1.999	2.510	1	2	3	4	1.500	1.999	5
2.510	2.999	1	2	4	5	2.000	3.999	4
2.999	3.999	1	2	3	4	—	—	—

a reasonable size and that it can reduce the number of gages required for a complete system.

A gage with a 0.005-inch limit, under the 10 percent rule, could have a maximum of 0.0005-inch wear allowance. In addition, the gage could wear below basic size by another 0.0005 inch before being withdrawn from service. It is easy to see that more than enough allowance for wear would thus be made.

However, when the maximum wear allowance above the basic size is limited to 0.0002 inch, then the Go gage end is suitable for any class of hole whose limit is 0.002, 0.003, 0.004 inch or larger. This limitation of wear allowance can reduce the cost of the gaging system because, if Go and Not Go gages are separated as for larger sizes, one Go gage can be used for any hole with a tolerance of 0.002 and above, while a series will only be required of Not Go gages to control the maximum size of the hole.

The use of color with the system would offer advantages both for tooling and gaging. Red is used for Class 1, green for Class 2, blue for Class 3, amber for Class 4, and black for Class 5 and above. Colored anodized aluminum handles on gages would insure immediate recognition in use or in storage.

Since it is a known fact that a new reamer cuts big, this same color code could be used for reamers by painting the shank or placing a colored synthetic rubber band between the top of the flutes and the shank. For example, if a ½-inch diameter hole is reamed 0.0008-inch oversize by a new reamer, it is apparent that the hole would be a Class 4 fit. If the shank of this reamer is colored amber, it will be recognized as one cutting 0.0008-inch oversize.

As the reamer wears and the holes it produces become progressively smaller, the color code would be changed at the various tolerance steps until it was painted red. As a Class 1 tool, it would then be one of the most valuable reamers in the shop. Using such a code system would extend reamer life and avoid scrap.

The system contains many other advantages that are associated with an ideal system without the disadvantages that are usually found with a system in practice. It is simple to understand and to use; it is practical since only practical tolerances would be used, and it should be acceptable to industry because it has been constructed to cover the entire range of industrial requirements. Since it is a complete system, it provides a range of tolerances that are suitable for products as varied as watches and heavy machinery. Its final advantage is inherent in its basic simplicity. The complete system can be concisely described by one wall chart.

With additional study and thought, this system may provide a link between American and British practice in such a manner that a common tolerance system may be brought into operation between all countries to provide international interchangeability. All of these positive results could be obtained by using existing gages and at no cost.

Table 4 Equivalents Chart of American and Pilot + 2 Tolerance Systems (0.0001 inch)

Diameter Steps Pilot + 2 U.S.A.	U.S.A. XX Tol.	Pilot + 2 Tol. Class		Difference	U.S.A. X Tol.	Pilot + 2 Tol. Class		Difference	U.S.A. Y Tol.	Pilot + 2 Tol. Class		Difference	U.S.A. Z Tol.	Pilot + 2 Tol. Class		Difference
.029																
.125	2	2	2	0	4	4	4	0	7	7	7	0	10	10	10	0
.825	2	2	1	0	4	4	2	0	7	6	3	−1	10	10	5	0
.999	3	2	1	−1	6	6	3	0	9	8	4	−1	12	12	6	0
1.510	3	3	1	0	6	6	2	0	9	9	3	0	12	12	4	0
1.99	4	3	1	−1	8	9	3	+1	12	12	4	0	16	15	5	−1
2.510	4	4	1	0	8	8	2	0	12	12	3	0	16	16	4	0
2.99	5	4	1	−1	10	8	2	−2	15	16	4	+1	20	20	5	0
3.99	5	5	1	0	10	10	2	0	15	15	3	0	20	20	4	0

(Minus sign indicates Pilot + 2 tolerance is tighter)

Elements of Statistical Quality Control*

By Lt. Commander W. W. Kauffman
U. S. Naval Gun Factory
Washington, D.C.

QUALITY CONTROL is a familiar practice in most production operations, but the statistical variety introduces a factor unfamiliar to many engineers. Statistics can be defined as the science of collecting and tabulating facts, but there are added connotations. It provides a means of analysis in order to secure the maximum information from the facts at hand, it provides means of determining how much confidence should be placed in the facts or how reliable they are, and it gives a key to determining how much data is needed, and how best to select the data. The field of statistics may be summed up as follows: collect, tabulate, analyze and conclude with known amount of confidence. This can be wrapped up as use of facts.

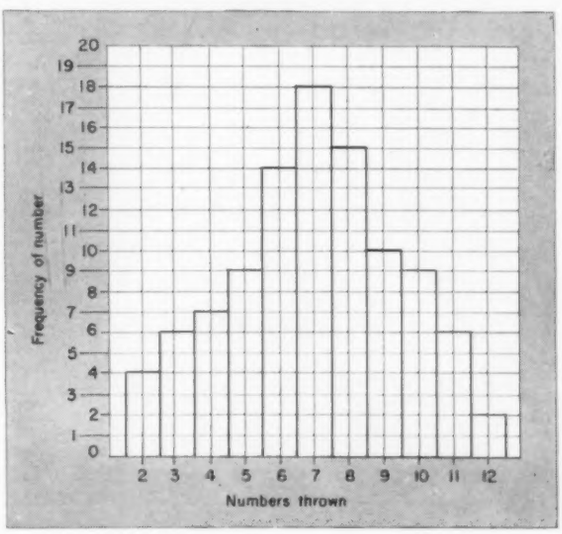
When statistics and quality control functions are combined as statistical quality control, it infers the use of facts about a process or product to determine its conformance to established requirements for the purpose of originating and maintaining adequate operating controls. All of the statistics used in industrial quality control stem from one common idea: variation.

Variation is common in industrial products. Produced parts differ from each other, batches of raw material vary in some characteristics; in fact so much so that their variations constitute a major production problem. When the idea of variation is accepted as unavoidably normal, statistics can be used as a tool in helping to control it. Statistics can help to define and interpret variation and lead to reasonable, valid conclusions concerning it.

As production men well know, the problem of controlling quality is essentially that of securing and interpreting the facts. Without quality control, a manufactured product tends to breed unwanted Sigmites,** those elusive creatures, found particularly in ordnance products, which thrive on assumptions and guesswork, and the attitude that quality is the concern of inspection alone. Applied to problems of quality control, statistics provide the means for making decisions based on fact rather than assumption.

An appreciation of the use of statistical methods can be gained from simple analysis of almost any uncontrolled data, such as the numbers occurring from rolling dice. *Fig.* 1 is a picture of variation resulting from 100 rolls of a pair of dice. Here is graphically represented information that could have been presented in tabular form. The numbers that were rolled are recorded on the horizontal axis. The frequency with which each number occurred

Fig. 1. Frequency distribution of 100 rolls of dice.



* Opinions or assertions expressed in this paper are the private ones of the writer, and are not to be construed as official or reflecting the views of the Department of the Navy or the Bureau of Ordnance.

appears on the vertical scale. Data presented this way is called a frequency distribution.

In *Fig.* 2 is shown the frequency distribution of a group of measured dimensions taken from a manufactured product. It can readily be seen that the enveloping curves of *Figs.* 1 and 2 resemble each other in shape. One is a distribution resulting from chance, the other the result of a manufacturing process; yet the two are similar. The perfect frequency distribution resulting from chance is shown by the smooth curve in *Fig.* 3. This curve is called a normal distribution curve. Statistics define the shape of this curve and show, in terms of increments of distance along the horizontal axis, the areas that are included betwen points on that axis. The distances ± 1, ± 2, and ± 3 standard deviations form the average and the corresponding areas included between these distances, are also shown in *Fig.* 3.

The normal distribution curve is superimposed over measurements from the manufactured product case study in *Fig.* 4. If the number of cases that had dimensions falling within the middle group are counted, it is seen that 67.5 percent fall between ± 1 standard deviations from the average as compared to a perfect 68 percent; 93 percent for ± 2 standard deviations compared with the perfect 95 percent; and 100 percent for the ± 3 standard deviations group as compared to a perfect 99.7 percent. Thus the distribution of measurements from a manufactured product conforms rather well to the statistical definition of a normal curve.

The spread or dispersion across the base of the two frequency distribution patterns, *Figs.* 1 and 2, represents the variation due to chance causes operating. Dice is a game of chance. *Fig.* 1 then represents pure chance, assuming normal dice. The spread across the base of *Fig.* 2 is also chance. It represents the effect of all of the singly insignificant factors that cumulatively cause one piece to be different from another.

All the independent factors working together that are involved in performing the operation represented by *Fig.* 2—vibration, bearing fit, hard or soft spots in material, minor variations in feed, speed, depth of cut, sharpness of tool, and many others—combine to develop this spread that conforms so closely to the curve resulting from chance. No attempt is made to control these factors as long as the spread of the natural process is within the spread of the tolerance specified. When control is necessary, statistical quality can point out operations where improvement is possible.

Here is one application of the idea of variation. Is the process capable of producing all parts within

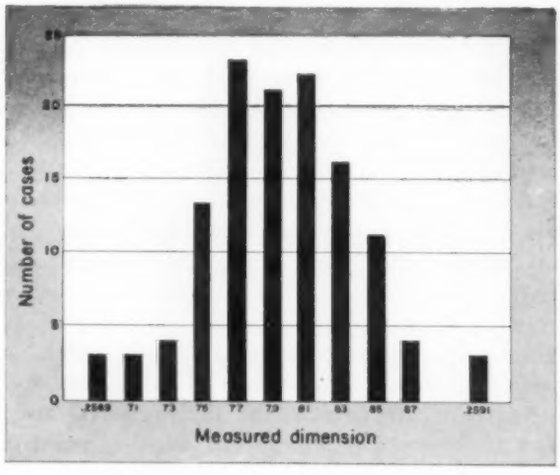


Fig. 2. (Top Left) Frequency distribution of variations in measured dimensions of a manufactured product.

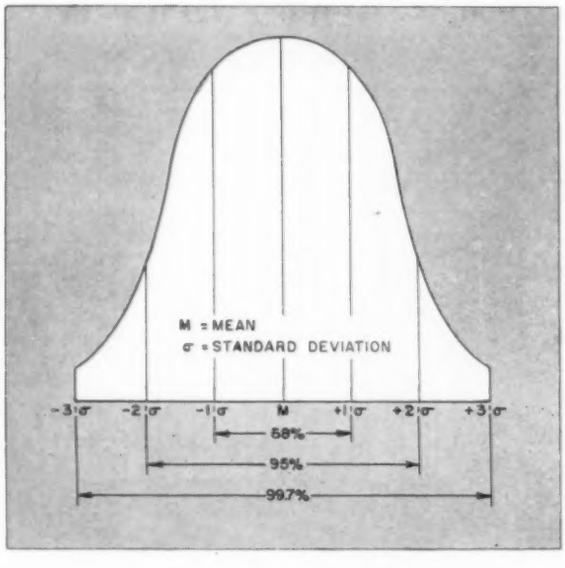


Fig. 3. (Bottom Left) Bell-shaped normal distribution curve represents a theoretically perfect case.

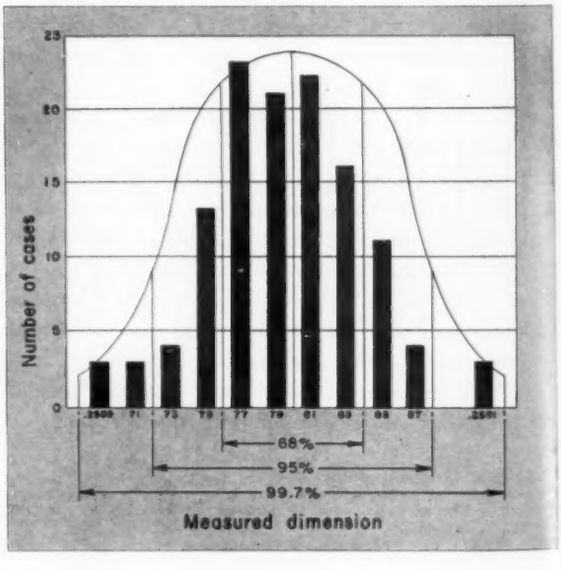


Fig. 4. (Bottom Right) Superimposing the normal curve on the actual data curve facilitates comparison.

specification? How much leeway is there between the normal spread and the specification tolerances? A frequency distribution pattern will help in deciding these questions.

What is probably the best known development of this idea of variation is known as the control chart. The chart might be considered a means of collecting the facts. Refinement of the chart by adding limit lines, permits distinguishing chance causes from those that can be detected and corrected.

In *Fig.* 5 is shown a control chart for average and range, constructed from data taken from the same process as *Fig.* 2. The chart is constructed by measuring a fixed number of samples (in this case five were used) at reasonably uniform intervals of time. For *Fig.* 5, samples were measured every four hours. The average of the group is plotted on the top half of the chart and the range, or difference between largest and smallest, is plotted on the bottom of the chart.

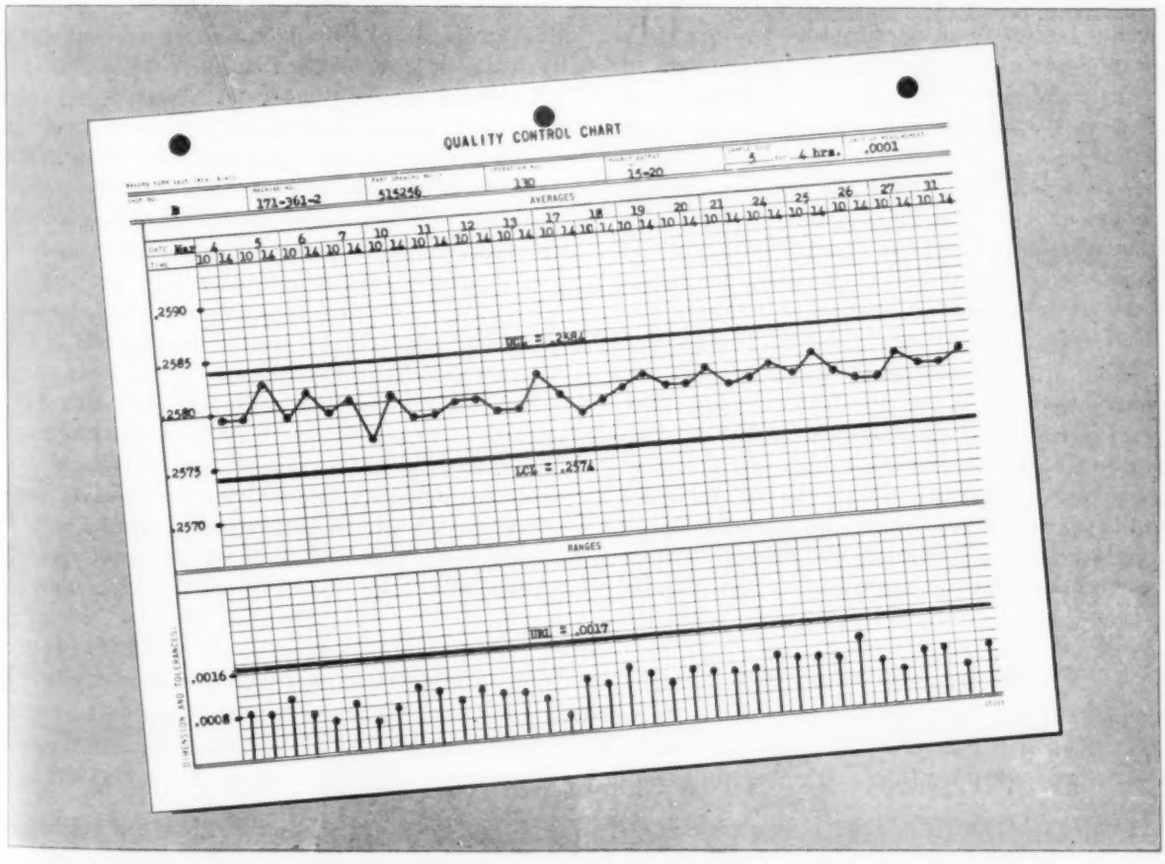
Process changes can be detected by watching the average with one eye, and keeping the other on range. The average is quick to show drift, while the range gives an idea of change in spread. Limit lines, which help tell the difference between chance cause and assignable cause can be readily calculated from tables published in all texts on statistical quality control. In general, ± 3 standard deviation lines are used for limits.

That the average chart is sensitive is shown in *Fig.* 6. The larger normal distribution curve was prepared from individual measurements of a large number of parts. The smaller crosshatched curve was prepared from averaged measurements of sample groups. The solid tolerance lines are at ± 3 standard deviations from the average of the individual measurement curve, and the dashed control lines are at ± 3 standard deviations from the average of the averaged measurement curve.

Assume that the process has shifted, *Fig.* 6b, until ½ of the averaged measurements fall below the lower limit line. In practice this means that alternate group averages would have equal chance of falling below the limit. The chance of detecting this change by watching the average is then 50-50, while the chance of detecting the change by judging on the basis of individual measurements is, in this case, about 7 in 100, the ratio of the black area in *Fig.* 6b to the total area under the curve.

Which procedure is better? To occasionally measure a piece or two at the production line and, judging from the result, conclude that the process is or is not producing pieces within specifications;

Fig. 5. An application of statistical methods to quality control. Limit lines supply index of variation.



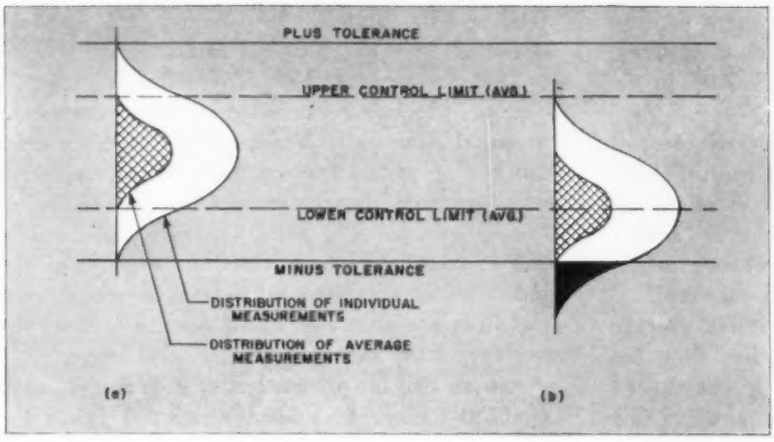


Fig. 6. Curves of average measurements of a group are more sensitive to change than curves of individual measurements: (a) acceptable results and (b) process changes are more readily noted by the average curve position.

or use as a guide the control chart with its limit lines, and judge the process by analyzing facts. The latter is the statistical quality control approach to controlling quality during manufacture.

The limit lines might be looked upon as action limits. As long as the process continues with the average and range inside the limit lines, production is permitted to continue. When either average or range goes outside these limits, an investigation is made to determine the reason. The chart detects the difference between chance cause and assignable cause. When the reason for the assignable cause is determined as soon as it is discovered and corrective action is taken, the manufacture of defective material is prevented. The value of statistical quality control is in detecting any real change in the process before defective material is produced.

There are many types of control charts. Some of them are fraction defective, percent defective, defect per unit, demerit per unit and number of defectives. All have one thing in common. Through the use of limit lines they separate chance causes from assignable causes so control action can be limited to areas that indicate a reason for action. When action is based on analysis of the chart, control is being exercised.

The third application of variation that has wide application is the standard sampling plan. It, of course, is an after-the-fact device. In other words, it is used to inspect products, not processes.

Sampling inspection is not new to tool engineers. Until ten or fifteen years ago, practically all sampling was done by inspecting a percentage of the material available for inspection. In the standard sampling plan, the chance of accepting poor and rejecting good is known in advance. Sample size and acceptance numbers are varied to keep this chance as constant as possible. Each combination of sample size and acceptance number has its own characteristics. When the chance of acceptance under the plan is plotted against percent defective, an operating characteristic curve is developed.

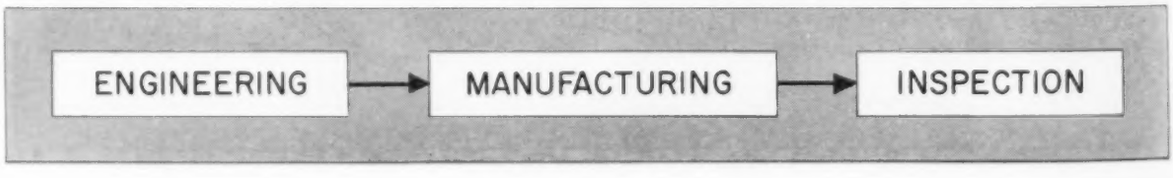
There are two general types of plans: (1) attribute inspection—the part is good or it is bad. Go-not-go inspection is inspection by attributes. (2) Variables inspection—measure the characteristic, determine amount of variation, calculate the dispersion and compare this to a standard to determine whether to accept or reject the lot of material.

The results of a study conducted recently by a well-known gage company can be cited to illustrate the effectiveness of these two plans. Using conventional sorting inspection, the labor cost per lot for inspection of 5000 parts was $37. Using MIL-STD-105A, the Military standard for attribute inspection, the labor cost was cut to 65 cents with an assured quality level of one percent defective.

By variables inspection, using a comparator to measure piece-to-piece variation, the labor cost was cut to 37 cents with an assured quality level of 0.3 percent defective. It is obvious why these sampling plans are gaining favor. They result in a reduction in scrap and in rework. A higher quality level is assured with fewer inspection man-hours required. Altogether this adds up to increased production, reduced cost plus improved quality.

The three principal tools of statistical quality control are:

Fig. 7. Straight line organization chart. Work flows from engineering to manufacturing to inspection.



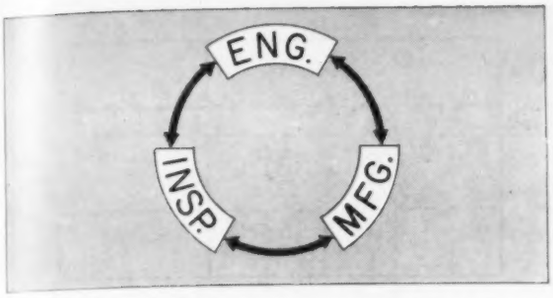


Fig. 8. Organization chart representing ideal of cooperation and coordination between departments with full interchange of information and sharing of responsibility for product, quality and price.

1. Frequency distribution—used to determine capability of a process
2. Control charts—used as a guide to action to maintain control
3. Standard sampling plans—statistics applied to acceptance by sampling.

Aside from the statistical portion, quality control also requires the cooperation of other sections of the industrial organization. Engineering and production departments can make definite contributions if there is proper coordination. A common viewpoint towards organization is shown in *Fig.* 7, a straight line type.

Viewed this way there is a tendency for each department to perform its portion of the job without reference to the others. Engineering designs the product, manufacturing makes it, inspection inspects it for conformance to requirements. Inspection at the end of the line has the authority for acceptance or rejection of the product, which often is misinterpreted to mean that the inspection department is responsible for quality. Sampling and inspection assume such proportions that the inspection department too frequently does not have time to search for causes and take corrective action to remedy the situation.

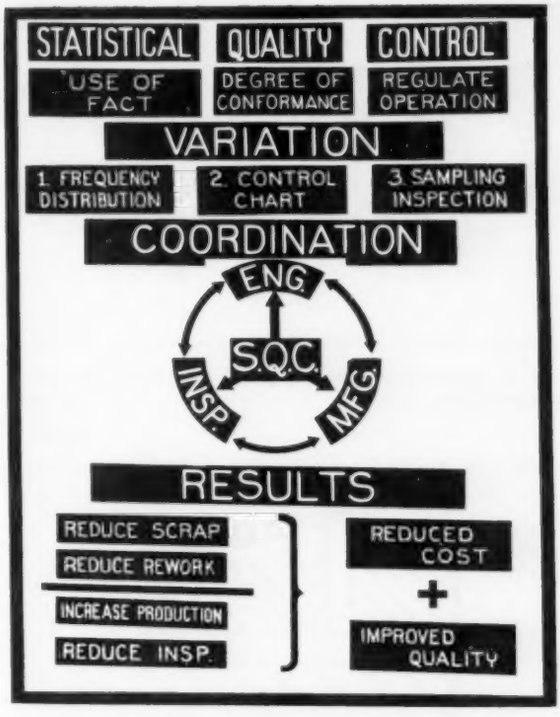


Fig. 9. Chart summarizing the dynamic approach to statistical quality control. S. Q. C. is the hub of the organizational wheel indicating the need for facts to tie all parts together.

Another concept is expressed by the wheel shown in *Fig.* 8.[1] In this organization there is a flow of information between departments, and the results of inspection are made known to engineering as well as to manufacturing. Changes can therefore be made as needed. How this fits into the over-all program is depicted by *Fig.* 9, which summarizes the application of a statistical control program and shows the end results.

1. "Statistical Method from Viewpoint of Quality Control." — W. A. Shewhart, The Graduate School, USDA, 1939.

Lapping Small Precision Splines

A NEW METHOD for lapping small internal splines and nonrolling external splines and gear forms permits production lapping of external splines that are of insufficient depth to allow continuous rolling contact with a lap in conventional external lapping machines, as well as production lapping of internal splines so small that it is impractical to make a lap that will roll with the spline.

For lapping the external splines, parts are chucked in an internal lapping machine. An internal toothed lap having the same number of teeth as the spline is mounted in a floating holder on the reciprocating lap spindle.

In operation, the work drives the lap and the lap spindle reciprocates on the work centerline while the work and lap rotate together. The lap spindle is braked hydraulically to give lapping action to one side of the splines. The work is rotated in the opposite direction to lap the opposite side of the splines.

For lapping internal splines, a similar arrangement is used with the internal splinded member in the chuck and the external splined member mounted on the lap spindle with a floating holder. Splines as small as 1-inch pitch diameter can be lapped by this method. The method, developed by Michigan Tool Co., is being successfully applied in instrument, aircraft and other applications where heat treatment distortions are a problem on precision parts.

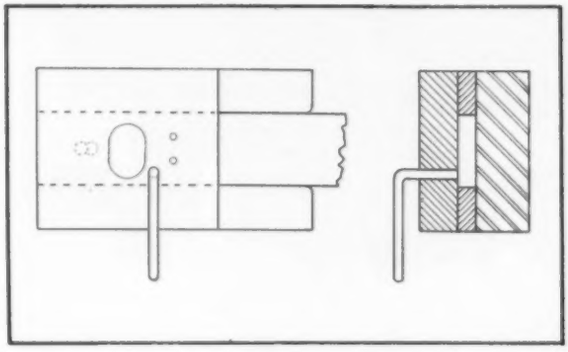


Fig. 1. Square hook stop is merely inserted in hole in stripper plate.

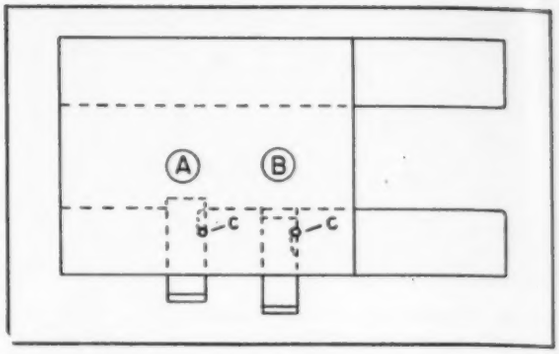


Fig. 2. Push-pull stop is also completely manual, but need not be removed.

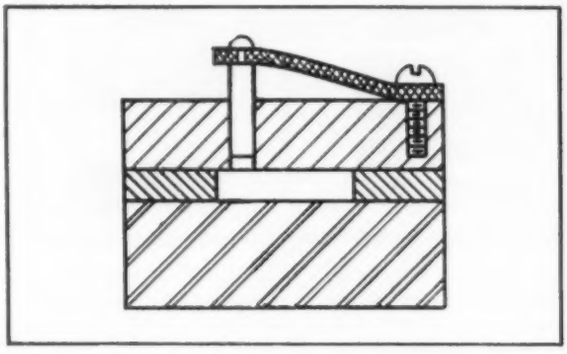


Fig. 3. Pin-type stop has flat spring return making it semi-automatic.

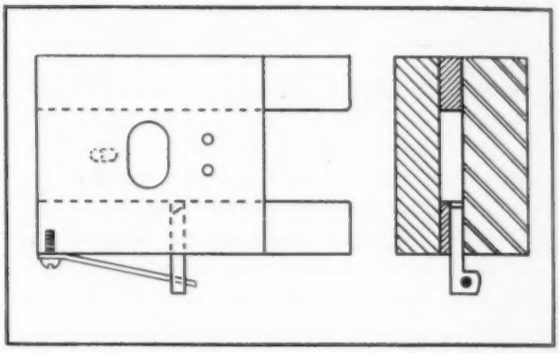


Fig. 4. Horizontal application of pin principle uses a square bar for stop body.

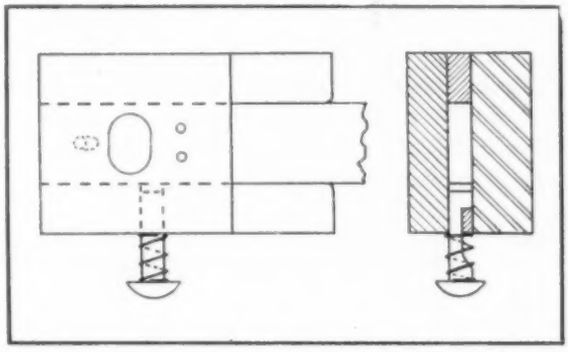


Fig. 5. Semiautomatic pin stop with coil spring is provided with limit.

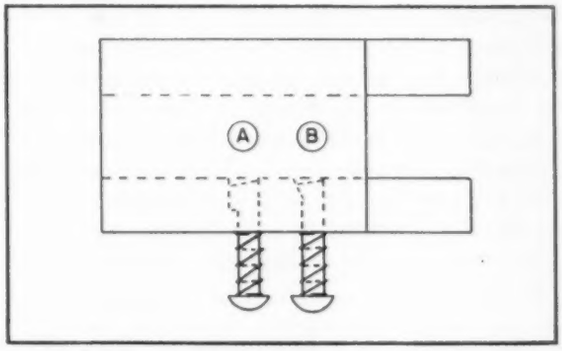


Fig. 6. Pin stops with alternate methods of limiting return travel.

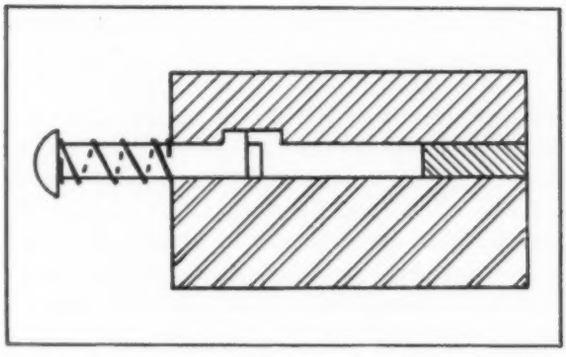


Fig. 7. Travel of this pin stop is limited by slot milled in stripper plate.

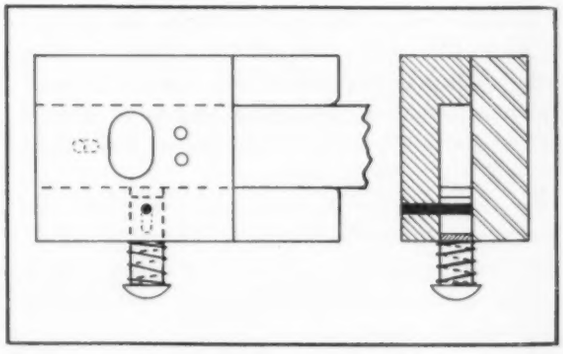


Fig. 8. Another method of limiting stop travel-slot and pin.

Station Stops for Progressive Dies REDUCE WASTE

By Federico Strasser
Santiago de Chile

PROGRESSIVE DIES are ordinarily equipped to correctly register the strip with the cutting openings only after the first blank has been cut. Without special provisions, the operator pushes the front of the strip against the definitive feed stop and the first blank stamped is blind, i.e. lacking the necessary punched holes. This results in waste of material and if the stock is in comparatively short strips, scrap may be considerable.

In order to save the first blank, the stripper is sometimes provided with small peepholes through which the operator can gage the starting edge position of the strips. This method is unreliable, depending on the operator's skill and attention, and is slow. For such cases, a station stop, known also as a starting stop, or finger stop, should be used.

In operation, the strip is pushed into the stripper opening up to the station stop which is so located that the blanking punch will always cut complete blanks; the press is actuated and the preliminary holes are punched. Now the station stop is released, the strip pushed along to the next station stop, if one is necessary, and the operation repeated. When the feed stop is reached, it takes over the location of the strip.

The station stops are manually operated. From a design and construction standpoint, they can be divided into three groups: (1) without springs, (2) with spring and (3) reverse operating.

Station Stops without Springs: The simplest device is a square hook. Steel wire of 3/16 or ¼-inch diameter is bent at a right angle and put in a hole drilled at the correct place in the stripper-plate, *Fig.* 1. After each strip is started, the hook must be taken out. This is a drawback because use of the stop is troublesome and it is easily lost. Hook stops should be used only as an emergency solution for rush jobs of short duration.

Another more precise method is shown in *Fig.* 2. A transverse canal is made in one of the stock guides, usually the front one, matching a rectangular piece of steel with a sliding fit. This stop is actuated simply by pushing it into the die, position *A*. It is made inactive by pulling it out, position *B*. Stop travel is limited in both directions by a small pin (*c*) matching a groove in the stop.

Station Stops with Springs (semiautomatic): Designs in this group are all of the plunger type, which must be pushed in the die and held during the starting operation. As soon as released, the stop automatically returns to inactive position, clearing the stripper opening.

They may be constructed in several ways, the basic designs being the following:

First, *Fig.* 3 is a short, straight, cylindrical pin secured to a flat spring that holds it so that normally the pin is buried in its guiding hole in the stripper. In operation, the pin is simply pushed down temporarily to stop the starting edge of the strip.

Analogous to the above design is the horizontal application of the same principle, *Figs.* 4 and 6. A square steel bar slides in a corresponding groove in one of the stockguides. The actuating spring is a piece of piano wire in *Fig.* 4.

Many tool engineers prefer helical springs to flat steel and straight piano wire springs. Semiautomatic stop designs with helical springs in both horizontal and vertical applications are common. The most frequently used design, *Fig.* 5, is similar to the one shown in *Fig.* 2. The stop travels in the stockguide transversely and is held open by a light spring. The edge shown with the arrow should be chamfered

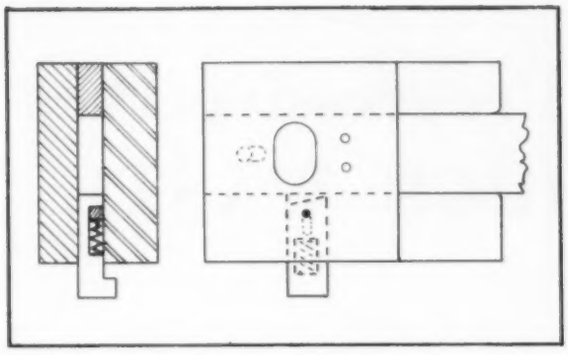


Fig. 9. Semiautomatic stop with return spring concealed in body of stop.

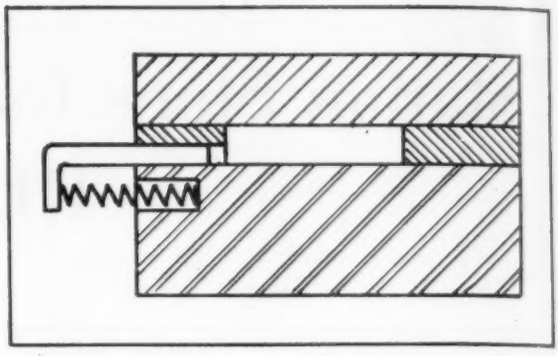


Fig. 10. Alternate design for hidden return spring requires recess in die.

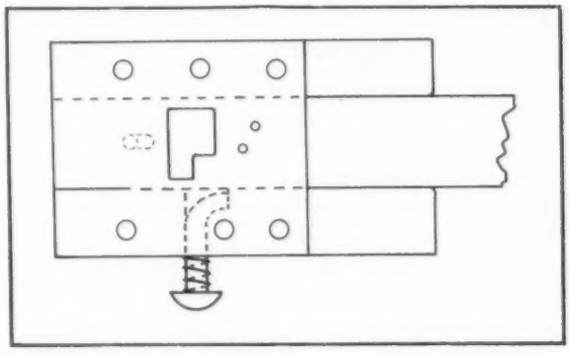


Fig. 11. "L"-stop which provides means of clearing die interferences.

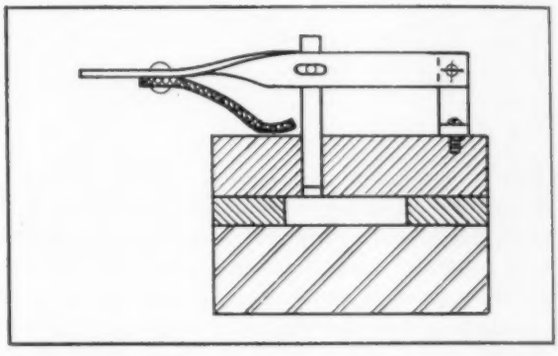


Fig. 12. Stop with lever and link motion has vertical action.

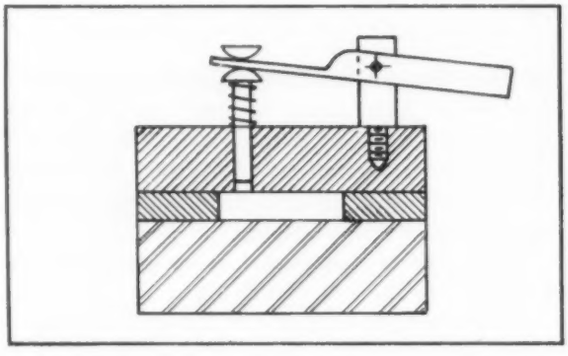


Fig. 13. Vertical stop with coil spring, actuated by raising lever.

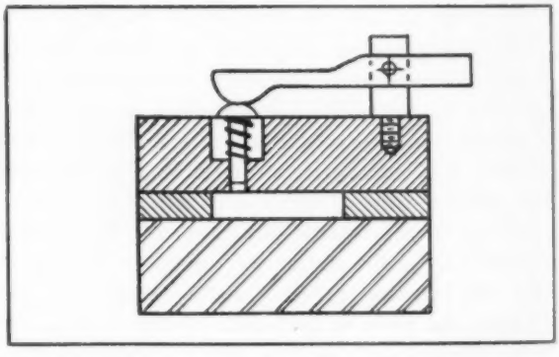


Fig. 14. Vertical acting stop with recessed spring used for small clearances.

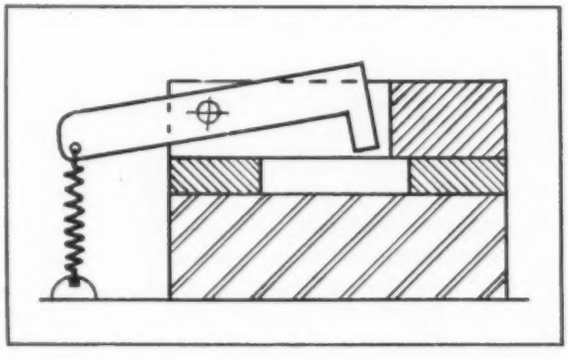


Fig. 15. Lever actuated stop with external return spring to hold it open.

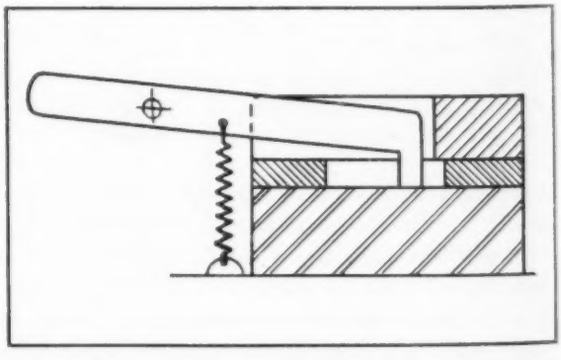


Fig. 16. Reverse operating stop which is normally closed for positive registration.

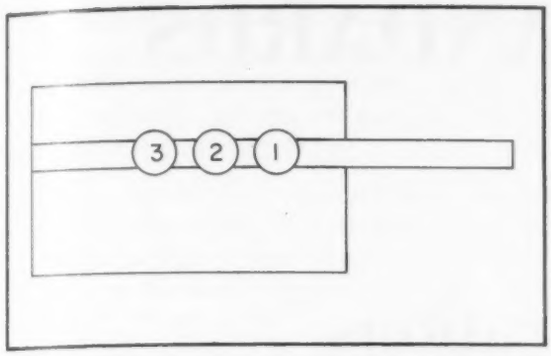


Fig. 17. Station stop knobs should be numbered in order of operation.

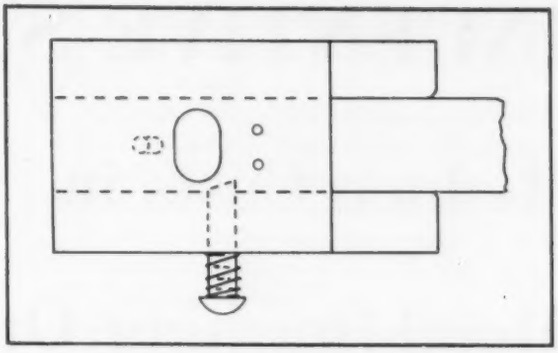


Fig. 18. Station stops are properly shown in closed positions on tool drawings.

liberally in order to avoid jamming the spring between stop and die.

The designs presented in *Figs.* 6 and 7 are similar to the one shown in *Fig.* 5 with the difference that the travel is limited differently. In another design, *Fig.* 8, the travel of the stop is limited by means of a pin in the bottom surface of the stripper which matches an elongated hole in the stop. This design is often used when the stockguide is milled out of the stripper.

Actuating springs are sometimes placed in the interior of the die, as in *Figs.* 9 and 10.

When the location of a station stop interferes with one of the holes in the stockguide, because of clamping screws or alignment dowel pins, then the starting stop is made "L"-shape to clear holes, *Fig.* 11.

Some toolmakers prefer vertical stops. To avoid any possibility of accidents caused by putting the fingers between punch holder and stripper, as is necessary in *Fig.* 5, it is advisable to actuate indirectly by means of simple lever arrangements. In the case shown in *Fig.* 12, a flat spring is used, in *Fig.* 13, a helical spring. In this latter instance, if there is insufficient space for the spring between stripper and punch-holder plate, the spring may be recessed in the stripper, as in *Fig.* 14.

Another semiautomatic stop is a design, *Fig.* 15, where the stop is held open by a helical spring, unless the operator activates the stop by lifting the lever.

Reverse Operating Station Stops: These stops are recommended for all progressive dies with pilots, either in the blanking punches or a separate one for indirect piloting. In these dies, if the beginning of the strip should fail to register correctly against the station stop and go through the tool without being pierced by the preliminary punches, the pilots would strike solid stock with disastrous results. For increased safety in these cases, foolproof station stops must be used, such as the one shown in *Fig.* 16. The stop is normally held in active position by a spring, i.e. it is always ready to stop the starting end of the strip. After the first perforation is made, the stop is lifted by hand and the strip is advanced.

Logically, the number of finger stops needed for a certain die corresponds exactly to the number of preliminary stations before the blanking operation. It is advisable to stamp upon the handles the order of use to avoid error, *Fig.* 17. In drawing a progressive die, it is good practice to show the station stops in operating position, in order to call attention to their presence, *Fig.* 18.

Wet Blasting Descales Dies

MANUAL POLISHING for removing heat-treat scale from parts for metal-cutting dies can be eliminated by wet blasting, it has been found by die makers at the American Wheelabrator and Equipment Corp., Mishawaka, Ind.

Reductions in the amount of hand polishing required for dimensioning the parts after scale removal are also experienced, because the close abrasion control which can be exercised during wet blasting cleaning permits closer machining and grinding of the work prior to hardening. Surface cracks do not occur with wet blasting.

A die consisting of 17 identical inserts for a metal-cutting job had surfacing time after heat treating reduced five hours, due to this process of scale removal. Cleaning of punch inserts was reduced 10 hours. These 15 hours represented an 80 percent polishing time saving.

The operator stands outside the machine with his arms through gauntlets and manipulates work in front of the abrasive gun inside.

The die maker is able to dimension the hole to exactly the correct size before heat treating, since with wet blasting it is possible to maintain tolerances within 0.0001 inch where necessary. Sharp lines, corners, etc., on work remain undamaged and unaltered. With this hole perfectly dimensioned and the whole part clean after wet blasting, it is possible for the diemaker to produce necessary outside dimensions without delay.

INCENTIVE STANDARDS

Reduce Costs in Metal-finishing Operations

By Anthony F. Cuoco and Alexander S. Hylicke*
Time Study Engineer Equipment Engineer

Eclipse-Pioneer Division, Bendix Aviation Corp.
Teterboro, New Jersey

COST REDUCTION may be obtained through the efficient utilization of manpower, methods and materials. The use of automatic machinery, and careful analysis and improvement of existing methods, have achieved excellent results in many organizations. Also, intelligent and farsighted purchasing of materials can prove a valuable source for reducing costs. In this article, however, attention is focused on the fertile field of manpower.

Incentive standards provide a measurment of the time required to perform a specific task. Moreover, the employee is given an opportunity to earn a premium for all production above that specified by the standard. Such a program obviously can be mutually beneficial. The earning potential of the worker is increased and at the same time, management attains greater production as well as a more efficient operating unit.

Incentive Benefits: Incentive standards are a direct outgrowth of the science of work measurement. In fact, some organizations employ work measurement without applying it on an incentive basis. Incentives enable the participant to share in profits obtained from increased production which results when work measurement is practiced. This is both desirable and equitable. There are other important, but less recognized, benefits which can be derived from any program of work measurement and incentive standards. Some of these benefits follow.

PRODUCTION CONTROL: A faster flow of work in and out of the various departments is obtained, eliminating bottlenecks caused by production lags. Time standards can be used to establish schedules which accurately determine the stage of manufacture that a part may be in at any specific time.

LABOR REQUIREMENTS: A problem constantly present is that of correctly determining the optimum labor load of a specific department. Idle operators provide a visible and costly indication of inefficient operation. Conversely, it may often be necessary to justify hiring additional employees. This is particularly true when new projects reach the production stage or increased production requirements necessitate expansion. Incentive standards readily indicate under or over-manned departments.

EQUIPMENT SURVEYS: Incentive standards may be advantageously used to compare existing and proposed equipment. The data obtained from these standards can easily be transformed into dollars and cents values to provide justification for continuing with the old or procuring new equipment.

PROCESS DEVELOPMENT: Often, when the process or tool engineer is deciding how a particular operation shall be performed, or when he is specifying tools and equipment for the job, he is faced with choosing between several alternate methods. Each way of doing the job may provide equally good

*Associate member ASTE N. New Jersey Chapter

results and the ultimate decision must be based on the factor of economy. Without data derived from incentive standards, the problem of choosing the best method to perform the operation can be resolved only by guesswork.

COST DATA: Work standards data can be the nucleus of an entire cost-accounting system. Direct and indirect labor time charges may be obtained and thus operating costs can be correctly analyzed for the various operations. To realize these benefits, it is necessary to determine accurately the manpower requirements for each particular operation. Work measurement and the incentive standards which follow, provide an efficient operating unit highlighted by a smooth flow of work, accurate labor load determinations, efficient use of processes, methods and equipment and valuable cost-control data. A lower unit cost, the goal of all industrial enterprises, is obtained.

This is specifically a report of work accomplished at Eclipse-Pioneer in establishing incentive standards for metal-finishing operations such as tumbling, barrel processing, metal cleaning and degreasing, sandblasting, heat treating, and descaling. Several of these installations are reviewed later in detail, but it may be stated at the outset that the facts, observations and conclusions which are discussed apply equally well to production processes in general.

Metal-Finishing Incentives: Metal-finishing operations are often excellent sources for cost reduction. The reasons are several. First, bulk processing is usually involved. That is, a large number of parts may be placed in a furnace or tank and processed simultaneously. Costs can be greatly reduced, insuring that maximum work loads are obtained depending upon capacity of the equipment and the quality desired. Second, processing cycles ranging from several minutes to ten or twelve hours are encountered. In order to operate at the lowest possible cost, the operators must be assigned other tasks during these cycles. The alternative is excessive operator idle time. Third, multiple machine assignments are possible. Because of the usually lengthy processing cycles, an operator may be assigned to handle several machines with a minimum of interference.

When these cost-reducing potentials are not fully exploited, conditions are as follows:

1. A lag in productive output is prevalent.
2. There is little or no job flow control.
3. The department is usually overstaffed to compensate for production lag.
4. Little time control is obtained; the proper ratio between manual and machine time has not been established.
5. Constant supervision is necessary in the attempt to increase production and improve work flow.
6. Quality suffers; no definite method of performing a job is established and hence results will be inconsistent.
7. Strained labor relations may exist; supervisors will be constantly trying to better production, but may lack tangible support for their demands.

These conditions are manifested in many ways. Often, for example, department areas are filled to capacity with parts waiting to be processed. This situation cannot be traced to the operator because he will work only as hard and as long as necessary. By the same token, the foreman can only estimate the output of his men and usually finds this estimate is difficult to support. Then, too, because of this production lag and the corresponding poor job flow, the routine of the department is further disrupted by production personnel trying to expedite a job that should have been out of the department weeks ago. As a result, additional employees are usually assigned to the department in an effort to alleviate the production backlog. The ill effects of such action are fully realized when this backlog of work is reduced. The supervisor then finds himself with an overmanned department. The alternatives available for solving this problem are operating the department with excessive idle time or attempting to assign excess operators to departments where work loads are heavier. Neither of these situations presents an inviting picture to management.

It is frequently found, where incentive standards have not been established, that equipment is not being used to its fullest capacity. The lack of work standards and of methods investigation is often manifested by insufficient work loads, improper time cycles and general misuse of equipment.

Due to the nature of metal-finishing operations, the problems resulting from improper or inadequate use of equipment are magnified. Productive bottlenecks are sometimes created in tumbling barrel departments simply because the proper barrel loads have not been determined. Similarly process cycles for an operation are often found to be excessive. A work measurement procedure tends to rectify these situations.

Another problem is the excessive supervision necessary to administer a department operating without measured work standards. The foreman must constantly be alert to maintain production at an optimum pace. It is his responsibility to ascertain from memory that the same method is used to perform a specific job time after time. Usually a different method is used to perform the job each time it repeats. When the foreman

is asked to reduce the cost of an operation, he has no accurate means of determining its cost.

Establishing Incentive Standards: Although several techniques of establishing incentive standards are available, the most economical and that employed with the most facility is the standard data method. Compared with direct time study, standard data once compiled can be applied at a much lower unit cost and with unparalleled consistency. For metal-finishing operations data can usually be established in a form simple enough to be applied by clerical personnel.

While standard data is of prime importance in establishing work standards, the final result will be successful only in proportion to the amount of effort and keen analysis utilized when compiling the data. A procedure similar to the following should be used when establishing incentive standards for metal-finishing operations.

PRELIMINARY SURVEY: This includes a general familiarization of the conditions and problems peculiar to the department in question. Discussions with the department foreman should be held and he should be made completely aware of the program to be attempted and what ultimate results are expected to be attained. His cooperation in the entire program must be sincerely solicited. At this point, a complete study should be made of the departmental layout, scope and range that the standards must cover as well as of the work methods employed, including possible improvements in these methods.

RECOMMENDATIONS: Suggestions and recommendations should be made regarding operational improvements. These include new equipment, improved methods and layout changes analyzed in the preliminary survey. It should be noted that the incentive installation should not be delayed because all recommendations are not immediately acted upon. It is important to bring these suggestions to the attention of management and identify them as an additional source of cost reduction. Changes frequently seem to occur only by a process of evolution. Considered in this manner, an immediate cost savings can be realized by proceeding with the incentive standards rather than wait for an anticipated savings at some future data.

COLLECTION OF DATA: The actual data required may be obtained from time studies in the company files, from studies taken specifically for the purpose of establishing the required data, or a combination of the two. It is usually found, however, that previous studies were not always compiled with the farsighted idea of using them for future data purposes. For this reason, they often lack sufficient detail to be useful. When recording time studies for data purposes, it is imperative that the starting and finishing points of each element be clearly defined. This is necessary so that each observer collecting data will have timed and recorded comparable elemental breakdowns.

APPLICATION OF DATA: No matter how thoroughly and conscientiously the data may have been collected, it will lose some of its value unless it is applied in a concise and easily understood form. Moreover, its accuracy must be beyond question. To achieve this accuracy, mathematical and graphical techniques of establishing normal elemental times must be applied intelligently. For variable elements the analyst must be certain that the proper variables are being considered. For instance, cursory analysis may indicate that the volume of the part is a governing factor while a more complete investigation will manifest that the weight must also be considered. These variable elements are usually plotted on rectangular coordinate paper with time values shown along the vertical axis and the dependent variable along the horizontal coordinate, *Fig.* 1. For constant elements, it is imperative that sufficient data be obtained to insure a correct selection of normal time values.

PRESENTATION OF DATA: Data may be presented in the form of elemental time analysis sheets with the elements in proper sequence for simple computation by time-study personnel. By far, the most advantageous method of presenting data, however, is in the form of multivariable charts, *Fig.* 2. With this type chart it is possible to include all conditions involved in an operation and at the same time obtain a standard directly from the chart in one reading. The construction of multivariable charts requires a certain amount of ingenuity and may appear to be time consuming. Nevertheless, they more than pay for themselves from the standpoint of the ease, simplicity and rapidity with which the standards are established.

ADJUSTING THE SYSTEM: Developing and establishing an incentive system is in many ways similar to designing a new product. The system must be tailored and changed to fit operating conditions. For example, it may be found while collecting data, some particular condition has been overlooked and must be provided for. Situations such as these can be compensated for only by testing, checking and adjusting the data where necessary. This is especially true because as the data continues in existence, so-called creeping changes enter the picture effecting continued beneficial application.

Studies of Actual Installations

The real value of the foregoing ideas can best

be illustrated by examples which clearly depict the results realized when incentive standards are established for metal-finishing operations. These examples will be discussed from the following points of view:

1. The situation existing prior to establishing incentive standards.
2. The problems that were met and how they were solved.
3. The cost savings that were realized.

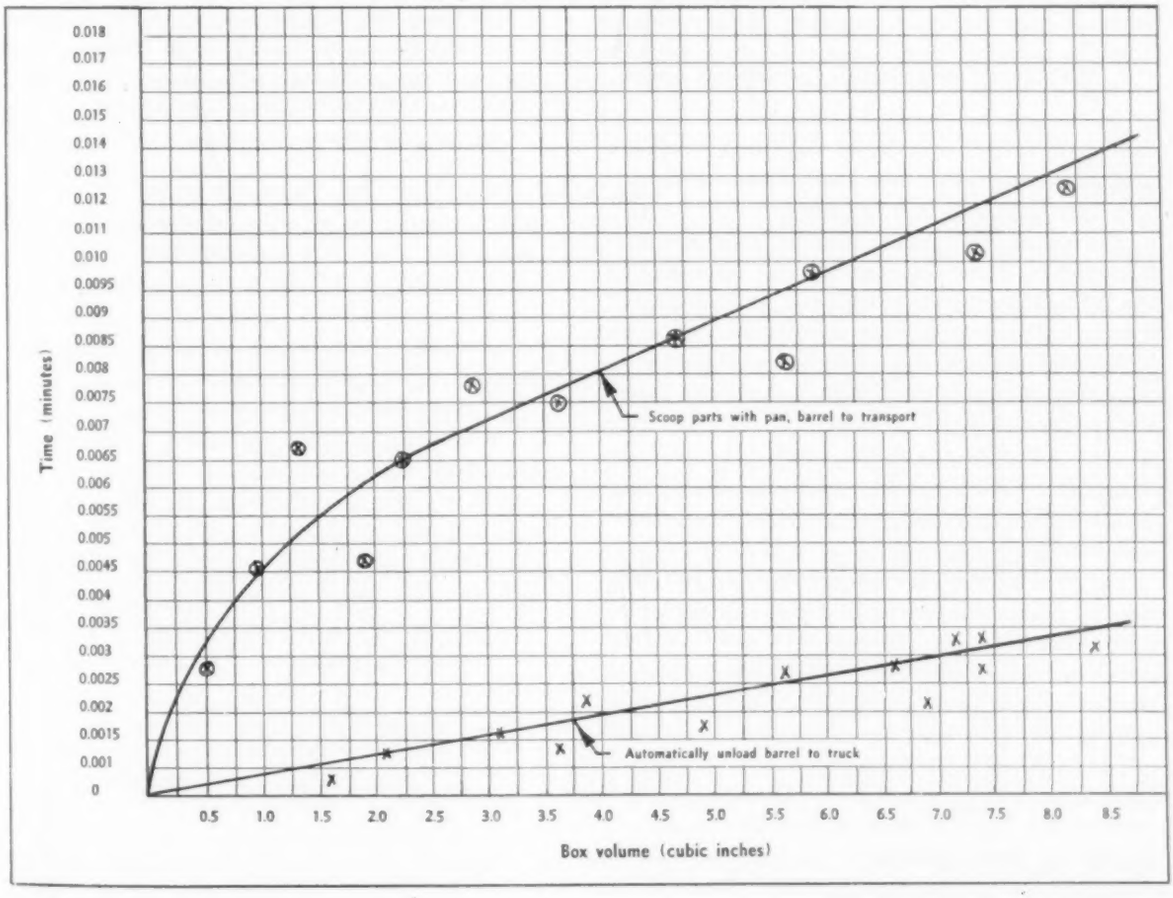
TUMBLING BARREL DEPARTMENT: This department represented a situation where the analysis of the manpower involved did not keep pace with technological improvements. Prior to consideration of a work measurement program, the entire tumbling barrel process was analyzed. New and modern equipment was purchased, the best barrel finishing materials were acquired and an extensive methodization program was undertaken. In addition, the data obtained were recorded on reference cards so that it became a routine task to achieve consistent results every time a job was processed. So far as methods and materials were concerned, the tumbling department was certainly on a modern, efficient and smooth-running basis.

In spite of the extensive improvements, it was realized that the cost of operating the installation must be reduced if the economy of the tumbling process was to be maintained.

During the methodization program previously described, a plant-wide emphasis was placed on deburring and otherwise finishing parts by tumbling rather than by the more familiar hand methods. The result was that tool and process engineers routed a great many new jobs to the tumbling department and reviewed old ones with an eye toward the more economical barrel process. This review proved fruitful and many operational analyses were revised to include barrel finishing.

Some months after the methodization program had been completed and barrel finishing thoroughly sold throughout the organization, the job flow from the tumbling department became extremely meager. This condition was greatly magnified by the additional work that was routed to the department. Quantities of work were soon stockpiled at the receiving areas waiting to be processed. The situation became so aggravated that jobs which could be advantageously tumbled had to be turned away because of the lack of barrel capacity.

Fig. 1. Typical curves for determining time values.



Unload - Barrels																									
LARGE - SUBMERGED							SMALL - SUBM'GD.					GLASS - JARS					OPEN - TYPE					SAWDUST			
SCOOP		HAND		MAGNET		AIR DRY	MAGNET		SCREEN		AIR DRY	MAGNET		SCREEN		AIR DRY	MAGNET		SCREEN		AIR DRY	LG. BBL		SMALL BBL	
Pcs. Per Load	Saw-dust	Oil or Air Dry	Saw-dust	Oil or Air Dry	Saw-dust	And Stone Pick	Oil or Air Dry	Saw-dust	Oil or Air Dry	Saw-dust	And Stone Pick	Oil or Air Dry	Saw-dust	Oil or Air Dry	Saw-dust	And Stone Pick	Oil or Air Dry	Saw-dust	Oil or Air Dry	Saw-dust	And Stone Pick	Oil	No Oil	Oil	No Oil
25	.214	.242	.234	.252	.235	.170	.130	.119	.132	.121	.146	.097	.085	.099	.088	.111	.132	.151	.134	.176	.130	.095	.032	.080	.051
28	.195	.223	.215	.233	.217	.153	.117	.106	.119	.108	.131	.087	.077	.089	.079	.099	.118	.136	.120	.157	.116	.086	.030	.071	.045
30	.186	.213	.206	.223	.208	.140	.108	.101	.110	.103	.122	.081	.072	.083	.074	.092	.110	.127	.113	.129	.109	.080	.028	.067	.042
32	.178	.204	.198	.204	.200	.134	.102	.096	.104	.098	.115	.074	.067	.078	.072	.087	.104	.117	.106	.121	.102	.076	.027	.062	.039
34	.170	.196	.187	.196	.193	.126	.096	.088	.097	.098	.108	.072	.064	.074	.066	.082	.098	.112	.100	.114	.096	.072	.025	.058	.037
36	.164	.189	.181	.189	.182	.119	.091	.083	.092	.085	.102	.068	.060	.070	.062	.077	.092	.105	.094	.107	.090	.068	.024	.056	.035
38	.158	.186	.175	.186	.175	.113	.086	.079	.087	.081	.096	.065	.058	.067	.060	.073	.088	.101	.090	.103	.086	.065	.023	.053	.033
40	.152	.178	.166	.178	.169	.107	.082	.075	.083	.077	.092	.061	.056	.063	.056	.069	.083	.095	.085	.097	.081	.062	.023	.050	.031
45	.142	.160	.155	.165	.157	.095	.073	.067	.074	.069	.081	.055	.049	.057	.051	.062	.074	.085	.076	.087	.072	.056	.021	.045	.028
50	.130	.151	.142	.156	.147	.086	.066	.061	.067	.063	.073	.050	.044	.053	.046	.055	.067	.077	.069	.079	.065	.050	.018	.040	.025
55	.123	.143	.134	.148	.138	.078	.060	.054	.061	.056	.067	.044	.039	.046	.041	.050	.060	.069	.062	.071	.059	.046	.017	.036	.023

***Fig.* 2. Typical multivariable chart for tumbling barrel processes. To establish a standard time per piece for unloading, the analyst determines the number of pieces per barrel load which is shown at the left and reads the time value under the proper headings.**

It was at first thought that this production lag was due to insufficient personnel. This belief proved false, however, when the addition of more operators failed to solve the problem. The question was finally asked "How long does it take to tumble a job?" At this point, the time-study department was called into consultation. It was immediately realized that incentive standards were necessary and a program of work measurement was required to supply the basic information.

In this case the standard data approach was used and after several months of collecting, analyzing and applying various time-study data, a system of incentive standards was prepared.

The results that were achieved with the tumbling barrel installation can best be illustrated by the following analysis of the cost savings gained. TABLE 1 shows these cost savings as a monthly percentage of cost reduction, in relation to the operating cost prior to establishing incentive standards. This analysis is shown for the first six months following the initial application of work standards. Conditions became stable at the end of the sixth month and the new reduced operating cost became constant.

The reasons for this substantial cost reduction can be briefly summarized. First, manpower requirements for the department in question were accurately determined. The analysis, which involved the use of data obtained from incentive standards, clearly indicated that the department was overmanned. When the recommendations of a reduced labor load were presented to management, they were looked upon with question. The increasing amount of nonproductive time, however, clearly indicated the action that must be taken, so the excess operators were transferred to other departments for greater utilization.

In this installation, another important source for reducing costs was evident. The tumbling department operates with an average processing cycle of about two hours. Improper work scheduling with all barrels either running or waiting to be unloaded at the same time, provided irregularities in job flow as well as excessive idle time. Data obtained from the incentive standards made it possible to devise a work schedule which provided a minimum of idle time and machine interference.

DEGREASING AND METAL CLEANING: The necessity for any investigation of manpower in this department was first brought to light in a somewhat usual manner. As before, a large production backlog manifested by stock piling of work waiting to be processed, brought the situation to the attention of the shop superintendent and plant manager. A preliminary survey indicated that a lack of operational control prevailed. No standard procedure was established for determining when and how a part should be cleaned. Frequently the responsibility for routing a part to the degreasing department was assumed by a dispatch clerk. Parts were at times routed to the degreasing department when no cleaning operation was necessary, holding up subsequent operations. The foreman assigned

Table 1—Cost Reduction from Incentive Standards

Month in effect	Percent
1	17
2	20
3	28
4	25
5	37
6	35

Tumbling Methods Card

PART NO.	FILO 609 S/S	DEPT. NO.	3410
OP. NO.	10	PART NAME	SCREW
MAT'L.	ST. STEEL	OP. DES.	TUMBLE
DATE	5-27-52	BOX VOL.	.025 CU. IN.
BBL	SMALL OPEN	PRE-BBL TREATMENT	
LOAD	400	WASH	
COMP.	#3	POST-BBL TREATMENT	
MEDIA	#6	AIR DRY	
CYCLE	1½ HRS		

HOW TRANSPORTED	CARRY	REMARKS
HOW LOADED	DUMP	
HOW UNLOADED	STONE PICK & OIL	
METHODS ENG'R. APPR.		
SUPERVISOR APPR.		

Time Study Analysis

Oper.	Description	Min.	Pct. All.	Pcs. Hr.	Dec. Min.	Dec. Hr.
A	Load	.005	15	10000	.006	.00010
B	Unload and Air Dry	.008	15	6660	.009	.00015
C	Stone Pick & Oil	.014	15	3750	.016	.00027

Time Study Eng. _____ Date _____

Fig. 3. Typical Methods Card. (Left) Front side used in a tumbling operation analysis. (Right) Reverse side of card used for time study analysis. Values are obtained from chart shown in *Fig.* 2.

to this installation had several other departments which seemed to require most of his attention. Only a minimum of time could be spent in supervising this department and almost no effort could be extended by the foreman on methods improvement and operational control.

It was decided that the proper method for attacking this situation would be with incentive standards. To establish an effective system of work measurement for the installation described, considerable preliminary work had to be done. After consultation with the department supervisor and a general exchange of opinions on the situation, it was decided that the first step would be to standardize the methods of operation. Various manufacturers of cleaning equipment were consulted and their recommendations analyzed in an effort to adapt them to the prevailing factory setup. For this degreasing operation, various sized baskets were used. These baskets were coded and their capacities were accurately determined. Frequently, cleaning in more than one type of solution was necessary. Also some parts were oiled after cleaning and others were carefully packed. All of this information was carefully analyzed and recorded on methods cards, *Fig.* 3, which were made available to the operator. He then had a complete record of each job to be processed and knew

Fig. 4. Chart represents a typical data sheet used in a degreasing installation. Values can be extended and totalled to determine the allowed time for the operation.

— Element Description —													Element Value	No. Pcs.	Ele. Time
Get and Aside Empty Basket					÷ Value By No. Pcs./Basket								.345	10	.035
Rack To and From Dispatch Area					÷ Value By No. Pcs./Rack								1.200	50	.024
Tote Pan To and From Dispatch Area					÷ Value By No. Pcs./Tote Pan								.572		
Tank Degreasing Cycle					÷ Value By No. Pcs./Basket								3.000	10	.300
Rinse In Varsol or Oil					÷ Value By No. Pcs./Basket								.500	10	.050
— PIECE HANDLING —															
Box Volume—	Cu. In.	1.-2.	2.1-10.	10.1-20.	20.1-30.	30.1-50.	50.1-80.	80.1-100.	100.-125.	126.-150.	151.-175.	176.-200.	201.-250.	251.-300.	
Individually—	Min./Pc.	.02	.22	.024	.028	.030	.032	.035	.040	.043	.047	.050	.053	.057	x2	.100
	Cu. In.	301.-350.	351.-400.	401.-500.	501.-600.	601.-700.	701.-800.	801.-900.								
	Min./Pc.	.064	.070	.080	.090	.100	.130	.140								
Box Volume—	Cu. In.	.1-.15	.151-.20	.215-.25	.251-.30	.31-.40	.41-.50	.51-.60	.61-.70	.71-.80	.81-.90	.91-1.00	1.01-1.25	1.26-1.50		
Handfuls—	Min./Pc.	.0017	.002	.0022	.0025	.0028	.0032	.0035	.0038	.0041	.0044	.0046	.0051	.0057		
	Cu. In.	1.51-2.00	2.1-2.5	2.51 3.0	3.1-3.5	3.51-4.0	4.1-5.0	5.1-6.0	6.1-9.0	9.5-15.						
	Min./Pc.	.0066	.0074	.0082	.0090	.0095	.011	.012	.015	.019						
Box Volume—	Cu. In.	01-02	.021-.03	.031-.05	.051-.07	.071-.10	.101-.15	.151 .20	.201-.30	.301-.40	.401-.60	.601-.80	.801-1.00	1.10-1.30		
Dump—	Min./Pc.	.000035	.00004	.00005	.000065	.00008	.00011	.00013	.00016	.0002	.00025	.00033	.00038	.00045		
	Cu. In.	1.31-1.62	1.63-2.0	2.1-2.5	2.51-3.0	3.1-3.5	3.51-4.0	4.1-5.0								
	Min./Pc.	.0006	.00075	.001	.0013	.0018	.0025	.0035								
												Total Time Allowed In Decimal Min.				.509

exactly what had to be done and how to do it.

With the process completely standardized, the job of establishing incentive standards was then pursued. After several months collecting and analyzing time-study information, standard data were established for the degreasing operation. The foreman was completely aware of the time-study procedure and was informed of the final result and what was to be expected of it. In addition, the operators were advised as to how they would be affected by this plan and were carefully instructed in how to follow the new procedures. In short, it was necessary to do not only a good technical job, but also a first-class selling job.

Again the real proof of the success of the work can be readily seen by the cost savings realized. For this installation, the cost of operating the department during the latter six months of 1951, during which incentives were applied, was compared with the operating cost for the first six months of the same year prior to the installation of the work measurement program. This analysis shows that 31 percent reduction in cost was obtained. This saving was realized first, by correctly determining the labor load for the department; second, by adequate control. The time-study engineer then completed the picture by applying the skill of his profession to the job to insure continued efficient and economical work methods. Finally, job standardization established that the operation would be performed only when necessary and that proper material and equipment would be used.

OTHER INSTALLATIONS: Similar work was done in other installations, such as sandblasting, heat treating and descaling. Generally a similar procedure was followed and comparable cost savings were realized. The need for investigation to reduce costs was usually evidenced by a production backlog, poor job flow, lack of operational control, improper use of material and equipment or realization that the labor load within the department had not been properly determined.

In each installation, the foreman of the department was consulted and all phases of the problem were clearly outlined and discussed. Method standardization was immediately begun. This is often a difficult task, because new ideas must be injected without completely disrupting normal routine of the department. The actual collection and analysis of time-study data is perhaps the most painstaking part of the installation. The entire project will be only as successful as the amount of effort exerted in compiling the data to be utilized. Finally the most important phase of the job is reached. That is selling the system of work measurement and incentive standards to both supervisor and worker. There is no half-way point. The people concerned must be completely convinced in order to secure their cooperation. If an employee believes in the plan only halfheartedly, he will do little toward making it a success. A program without the interest and cooperation of the worker is futile, and can only lead to disastrous results.

Vertical Broaching Machine

STANDARD broaching machines have been made adaptable for broaching intricate internal contours of aircraft engine parts simply by an ingenious setup.

In the operation, six identical contours between the internal lobes on the part are broached in two passes, three alternate contours in the first pass, and the remaining three in the second pass. A two station fixture is necessary to facilitate locating from the offset holes in the part. The part is shifted to the second fixture which is shuttled in broaching position for the second pass.

An interesting feature is the use of a built-up type broach incorporating inserted broach sections. The machine is a standard 15-ton, 66-inch stroke pull-down single ram broaching machine made by Colonial Broach Co. Multiple guide shoes guide the broach above and below the part. These shoes contact grooves in the broach during vertical travel, or dimensional accuracy.

Twelve dowels in the fixture, six above and six below, engage six holes in the six lobes in the part. Complete support of the six lobes is thus provided while the part is being broached, holding the thin walled projections so as to effectively prevent distortion during the broaching operation.

The side shuttling fixture has a central opening through which the broach is returned after each pass. All movements of the shuttle are controlled and interlocked by limit switches, and operated hydraulically by the hydraulic system of the machine.

The machine goes through one broaching cycle and returns automatically. It is then reactuated for the second pass to insure that the second fixture is loaded and in correct position for the next pass of the broach.

three gears with equal radii of 1.25 inches and known center distances of 5, 4 and 4 inches, as in *Fig.* 1. Find the diameters of the gears that will be

How to Find a Gear Tangent to Three Other Gears

By Joseph Polonski*

Detroit, Michigan

THE PROBLEM of determining the pitch diameter of a gear that will be tangent to the pitch diameters of three other gears often arises in the design of multiple drill heads and gear trains for machines. Since the pitch diameters indicate regular circles, the following discussion applies to any circular layout.

Individual problems fall into one of three distinct groups, each of which has two cases. Gears can be found that are either internally or externally tangent to three other gears when: (1) the gears are equal in diameter, (2) two of the gears have equal diameters and (3) all three have different diameters.

There are two general methods for solving any of these basic problems, but the determination of gears tangent, internally or externally, to three equal gears can be handled more simply by other calculations. This is because the center for the tangent gears will be located at the same point as the center of a circle circumscribed about the triangle formed by joining the gear centers.

A graphical description of this problem is shown in *Fig.* 1 where A, B and C represent three gears with equal radii and known center distances, a, b and c. Point O is the unknown location of the center of two gears: one, with a diameter d, externally tangent; the other, with a diameter D, internally tangent to the three given gears. R' is the radius of the circle that circumscribes the gear centers and r is the radius of the known gears.

The following equations, in their given order, are used to determine the diameters of the tangent gears.

$$B = \text{Cos}^{-1}\left(\frac{a^2 + c^2 - b^2}{2ac}\right) \quad \ldots\ldots(1)$$

$$2R' = \frac{b}{\text{Sin } B} \quad \ldots\ldots(2)$$

$$d = (2R' - 2r) \quad \ldots\ldots(3)$$

$$D = (2R' + 2r) \quad \ldots\ldots(4)$$

To illustrate the use of Equations 1-4, consider

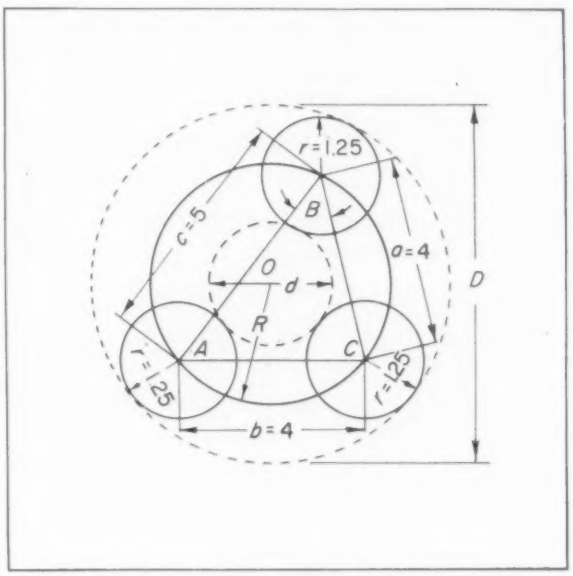


Fig. 1. Dimensioned diagram illustrating the method of finding radii of gears internally and externally tangent to three gears of the same diameter.

*Senior member ASTE Detroit Chapter.

three gears with equal radii of 1.25 inches and known center distances of 5, 4 and 4 inches, as in *Fig.* 1. Find the diameters of the gears that will be internally and externally tangent to the three given gears.

$$B = \text{Cos}^{-1}\left(\frac{16+25-16}{40}\right) = \text{Cos}^{-1}\ (0.62502)$$

$$= 51°\ 19'$$

$$2R' = \frac{4}{0.78061} = 5.124 \text{ inches}$$

$$d = (5.124 - 2.500) = 2.624 \text{ inches}$$

$$D = (5.124 + 2.500) = 7.624 \text{ inches}$$

Therefore, the diameter of the gear that is externally tangent to the given gears is 2.624 inches, and the diameter of the gear that is internally tangent to the given gears is 7.624 inches.

One of the general solutions, applicable to all groups, is diagramed in *Fig.* 2 for the condition of three gears, *G*, *H* and *J*, with unequal diameters and known center distances *A*, *B* and *C*. By adding several construction lines and following straightforward trigonometric and algebraic procedures, a general equation may be derived that applies to all gears internally or externally tangent to three other gears of equal or unequal diameters.

During the derivation, designations *K*, *L* and *M* are introduced to keep the general equation as simple as possible. In terms of known dimensions these three terms are:

$$K = (G-J)^2 - A^2 \quad \ldots\ldots (5)$$

$$L = (G-H)^2 - B^2 \quad \ldots\ldots (6)$$

$$M = (J-H)^2 - C^2 \quad \ldots\ldots (7)$$

Reduced to its simplest form, the general equation is:

$$(K^2 + L^2 + M^2 - 2KL - 2KM - 2LM)R^2$$

$$+ (2K^2H + 2L^2J + 2M^2G - 2KLH - 2KLJ - 2LMG - 2LMJ - 2KMH - 2KMG)R$$

$$+ (K^2H^2 + L^2J^2 + M^2G^2 - 2KLHJ - 2KMGH - 2LMGJ - KLM) = 0 \quad \ldots\ldots (8)$$

This is a quadratic in the form: $aR^2 + bR + c = 0$, in which the coefficients are:

$$a = K^2 + L^2 + M^2 - 2KL - 2KM - 2LM \ldots (9)$$

$$b = 2\,[K^2H + L^2J + M^2G - KL(H+J) - KM(G+H) - LM(G+J)] \ldots\ldots (10)$$

$$c = K^2H^2 + L^2J^2 + M^2G^2 - 2(KLHJ + KMGH + LMGJ) - KLM \ldots\ldots (11)$$

All quadratic equations can be solved by use of the following standard root equation:

$$R = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \ldots\ldots (12)$$

Solution of the root equation yields two values for

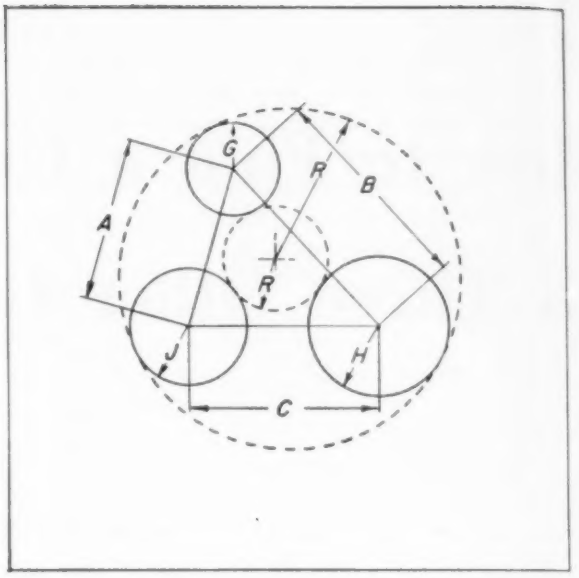


Fig. 2. This diagram illustrates the general solution for the problem of finding radii of gears internally and externally tangent to three gears. In this instance, the three gears have different diameters.

R. The larger numerical value is the radius of the gear internally tangent to the three known gears, and the smaller value is the radius of the gear externally tangent to the three known gears, regardless of mathematical sign.

The general formula, Equation 8, could be used to solve for *R* by substituting the given numerical values for their known symbols. However, to minimize the possibility for error, the formula is solved in small parts.

Using Equations 5-7, values are found for *K*, *L* and *M*. These values are substituted into Equations 9-11 to determine values for *a*, *b* and *c*. To further simplify the mathematical manipulation, the last three values are each divided by the value of *a*. The reduced values of *a*, *b* and *c* are then substituted into Equation 12 to obtain the radii for the internally and externally tangent gears.

As an example of this method, the following problem shows how to find the radii of two gears that are tangent, one externally and one internally, to three unequal gears. With reference to *Fig.* 2, numerical values for letter designations are: $G = 1$, $H = 1.5$ and $J = 1.25$ inches, and $A = 3.5$, $B = 4.5$ and $C = 4$ inches.

$$K = (1 - 1.25)^2 - (3.5)^2 = -12.188$$

$$L = (1 - 1.5)^2 - (4.5)^2 = -20.000$$

$$M = (1.25 - 1.5)^2 - (4)^2 = -15.938$$

$$a = -710.938$$

$$b = -1792.578$$

$$c = 2804.321$$

These values are reduced by dividing by –710.938

nally and externally tangent to three gears can

and give:

$a = 1.000$

$b = 2.521$

$c = -3.945$

Then:

$$R = \frac{-2.521 \pm \sqrt{(2.521)^2 - 4(1)(-3.945)}}{2(1)}$$

$= 1.092$ and -3.613

Therefore, the gear that will be externally tangent to the three unequal gears has a radius of 1.092 inches. The radius of the gear internally tangent to the three gears is 3.613 inches. Calculations are carried to only one more significant figure than will obtain in the radius specification.

The other method for determining the radii of gears tangent to three other gears is based on equations derived from the sketch in *Fig.* 3. All equations are derived by the rule that the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other sides.

In $\Delta\ OLX$, $\overline{LX} = \sqrt{(R+G)^2 - (D-F)^2}$

Then $\overline{LM} = E - \sqrt{(R+G)^2 - (D-F)^2}$

From Δ's XMY and XMZ

$$D = \frac{B^2 + C^2 - A^2}{2C} \quad \ldots\ldots (13)$$

In $\Delta\ XMZ$

$$E = \sqrt{B^2 - D^2} \quad \ldots\ldots (14)$$

From Δ's OKY and OKZ

$$F = \frac{2R(H-J) + C^2 + H^2 + J^2}{2C} \quad \ldots\ldots (15)$$

$$D - F = \frac{B^2 - A^2 - H^2 + J^2 - 2R(H-J)}{2C} \quad \ldots\ldots (16)$$

The general equation involving radius R is derived from Δ's OLX, OLM, OKZ and OKM.

$$\frac{E^2+C^2-D^2-H^2+2DF-2R(H-G)}{2E} = R^2+2RG+G^2-(D-F)^2 \quad \ldots\ldots (17)$$

This is a quadratic equation but must be reduced to the form $aR^2 + bR + c = 0$ before it can be solved with the root equation. Since reducing Equation 17 is cumbersome, it is better to substitute numerical values for G, H, J, A, B and C in Equations 13-16. The values obtained from these equations are then inserted in Equation 17, and it is reduced to the general quadratic form. Solution of the root equation, Equation 12, gives two values for R, the numerically smaller of which is the radius of the externally tangent gear, and the larger of which is the radius of the internally tangent gear, regardless of mathematical sign.

Using *Fig.* 3 and values of $A = 3.5$, $B = 4.5$, $C = 4$, $G = 1$, $H = 1.5$ and $J = 1.25$ inches, determine the radii of internally and externally tangent gears.

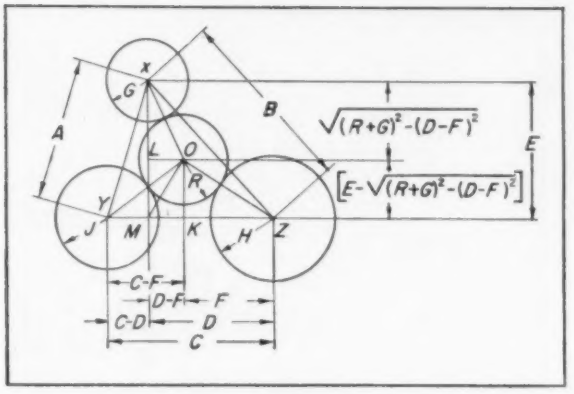


Fig. 3. This diagram illustrates another method for determining the radii of gears tangent to three other gears. The three gears can have the same or different diameters, as is illustrated above.

$$D = \frac{(4.5)^2 + (4)^2 - (3.5)^2}{2(4)} = 3.000$$

$$E = \sqrt{(4.5)^2 - (3)^2} = 3.354$$

$$F = \frac{2R(1.5-1.25) + (4)^2 + (1.5)^2 - (1.25)^2}{2(4)}$$

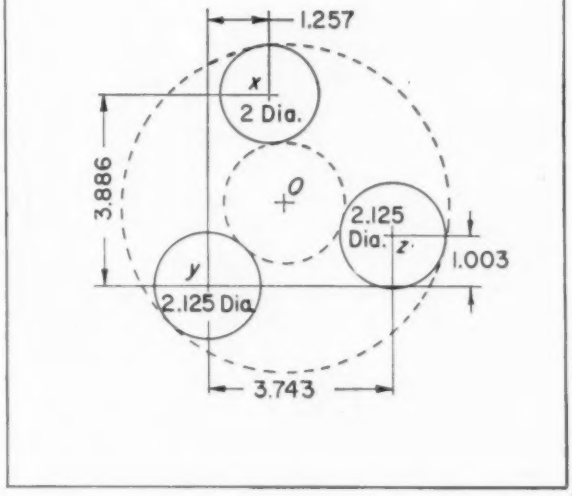
$$= \frac{0.5R + 16.688}{8}$$

$$D-F = 3 - \left(\frac{0.5R + 16.688}{8}\right) = \frac{7.313 - 0.5R}{8}$$

Upon making all indicated substitutions in Equation 17, reducing it to its simplest form and clearing fractions, the result is:

$$R^2 + 2.521R - 3.945 = 0$$

Fig. 4. This method of locating centers for the three gears introduces an additional step before the radii of the tangent gears can be found. It is first necessary to determine the distances between the centers of the gears; i.e., x to y, y to z and z to x.



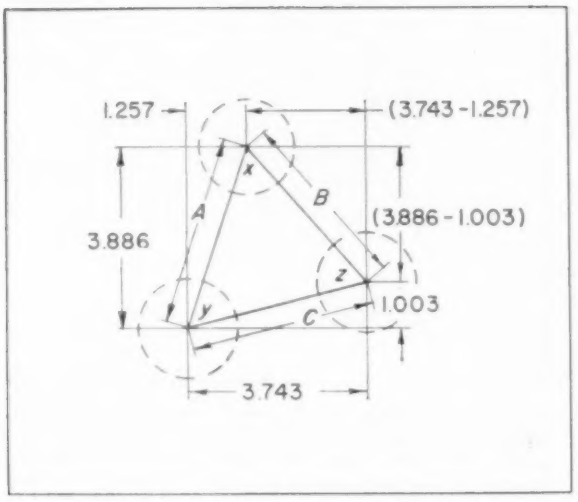


Fig. 5. The center distances for the gear layout of *Fig.* 4 are found in this manner using the rule that the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other sides.

By using the equation for the roots, Equation 12, the radius of the gear externally tangent to the three given gears is 1.092 inches. The radius of the internally tangent gear is 3.613 inches.

This method for finding the radii of gears internally and externally tangent to three gears can be used when the three gears have the same diameter, when two of them have the same diameter or when none of them have the same diameter.

Frequently the sizes of the three gears will be known, but their center distances will not. The gear centers will be located as in *Fig.* 4 and it is necessary to first find the distances between centers. Since each center distance is the hypotenuse of a right triangle in which the other two sides are known, as in *Fig.* 5, it is a simple matter to determine them.

$$A = \sqrt{(3.886)^2 + (1.257)^2} = 4.084 \text{ inches}$$

$$B = \sqrt{(2.486)^2 + (2.883)^2} = 3.807 \text{ inches}$$

$$C = \sqrt{(3.743)^2 + (1.003)^2} = 3.875 \text{ inches}$$

Noting that the circles are described by diameters rather than radii, the given values are divided by 2 to obtain values for *G*, *H* and *J*. With these and the determined values for *A*, *B* and *C*, the radii of externally and internally tangent gears can be found by using Equations 5-7 and 9-12. Although illustrated by a problem involving three gears, the diameters of two of which are equal, this method of finding center distances can be used in any of the cases outlined.

Investigate Ceramics for Nuclear Reactors

PERHAPS the most extensive laboratory of its type in the atomic energy program is the new ceramics department of the Oak Ridge National Laboratory, which Union Carbide and Carbon Corp. operates for the Atomic Energy Commission. In the breadth and diversity of the investigations and studies being undertaken in its research programs it is rapidly becoming recognized as the center of ceramic research as applied to nuclear energy activities in this country, and is playing a highly important role in the overall atomic research programs.

One of the outstanding problems in the development of nuclear power is to find suitable material for the construction of nuclear reactors or atomic furnaces, particularly since many of the service requirements are highly unusual. Reactors operating at temperatures over 800 F may prove to be the most economical system for nuclear power production. Most metals are limited to service below 1500 F. However, ceramic materials that can withstand elevated temperatures offer a possible solution to the problem. Therefore the development of a new ceramic material or adaptation of a previously known one for high-temperature work where metals or alloys are unsuitable is highly important to the nation's nuclear energy program.

Cermets—combinations of ceramic materials and metals with the best qualities of both—are possible white hopes for reactor materials research. But Cermet studies are only a part of the Oak Ridge National Laboratory ceramic research program. Other important features include study of oxide, boride, and nitride ceramics as structural materials; techniques for the application of ceramic coatings to materials used in reactors; and evaluation of the effect of radiation damage on ceramic materials.

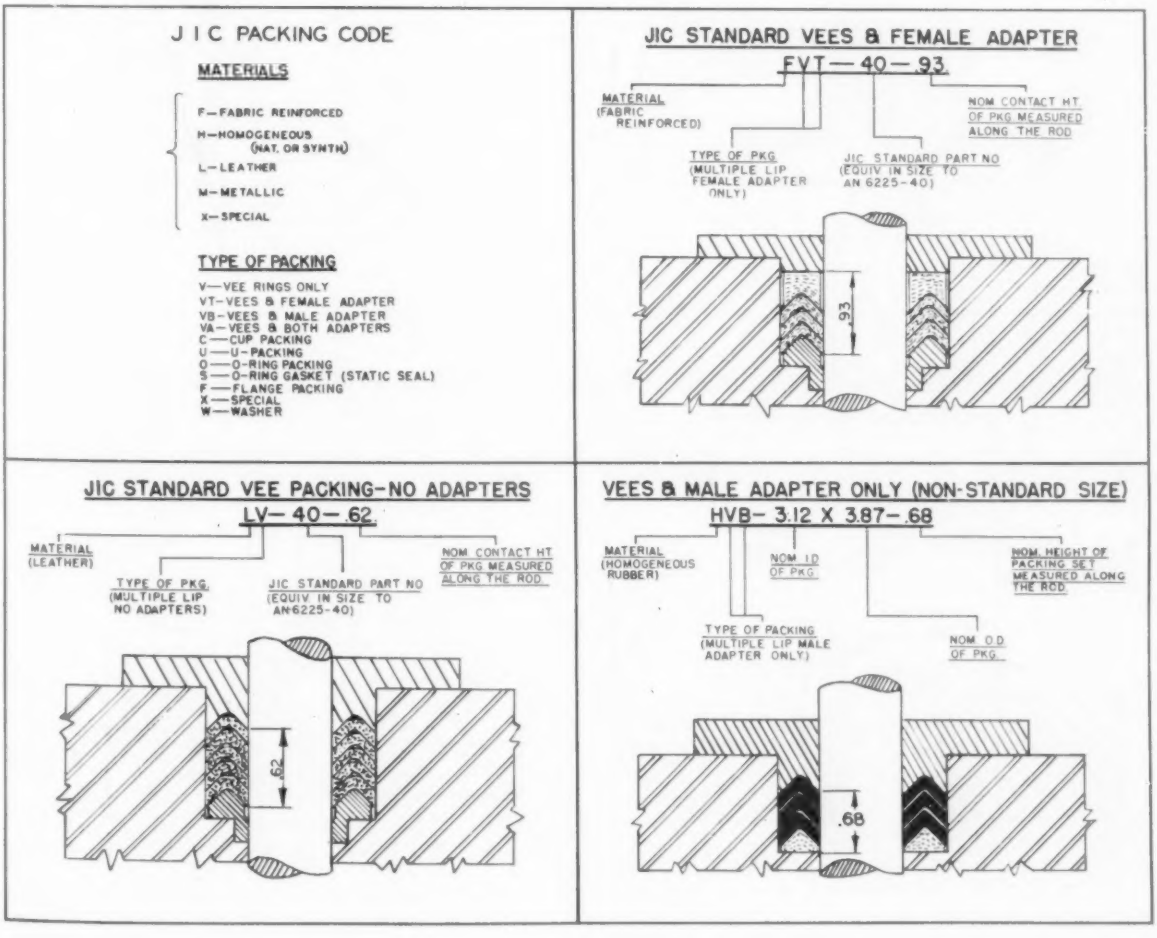
In addition to its program of fundamental and applied research projects, the members of the department do consulting work, aid in the design of specialized apparatus, and lend personal assistance wherever it is needed in investigations under way in the other departments of the laboratory and in the production of isotopes and fissionable material. Oak Ridge National Laboratory is the foremost producer of radioisotopes, used so extensively in medicine, agriculture, industry, and general research.

The ceramics department, headed by Dr. J. M. Warde, is part of the Oak Ridge National Laboratory Metallurgy Division under Dr. J. G. Frye, Jr. Dr. Warde was engaged in industrial ceramics work in the United States and in South Africa for 17 years and served as ceramic specialist in the Economics Division, Office of Military Government for Germany (US) prior to his coming to the Oak Ridge laboratory. He received his B. S. in ceramics at the University of Alabama, his M. S. from Montana School of Mines, and his Ph.D. from the University of Capetown, South Africa.

JIC Hydraulic Packing

THE MAJOR 1953 revisions to the hydraulic standards of the Joint Industry Conferences consist of the addition of the JIC packing code, recommended practices for hydraulic packings and seals, presented here, and revision of section H1-Diagrams which will be published in these pages next month. The dash numbers shown in the left hand columns of the tables are for reference purposes only and have no other significance. Only nominal commercial sizes recommended for new designs are shown. Sizes and materials are for guidance when these types are used. It should not be construed that other types of packing are not acceptable.

JIC Packing Code



JIC STANDARD VEES & BOTH ADAPTERS

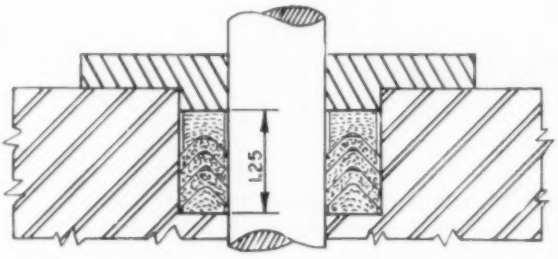
LVA—40—1.25

MATERIAL (LEATHER)

TYPE OF PKG (MULTIPLE LIP BOTH ADAPTERS)

JIC STANDARD PART NO (EQUIV IN SIZE TO AN 6225—40)

NOM CONTACT HT OF PKG MEASURED ALONG THE ROD



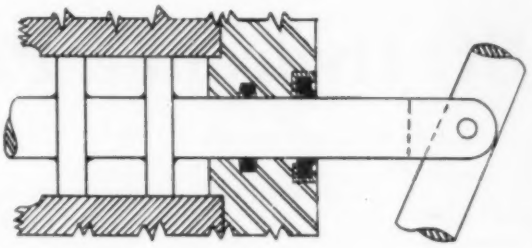
JIC STANDARD O-RING PACKING

HO—40

MATERIAL (HOMOGENEOUS RUBBER)

TYPE OF PKG (O—RING)

JIC STANDARD PART NO (EQUIV IN SIZE TO AN 6225-40)



CUP PACKING (NON-STANDARD SIZE)

HC—3.06 X 1.00 X .12 - .50

MATERIAL (HOMOGENEOUS RUBBER)

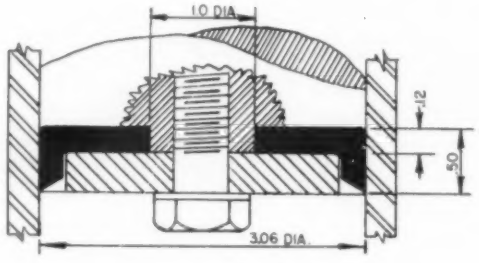
TYPE OF PKG (PISTON CUP)

NOM CYLINDER BORE DIA.

HOLE DIA

THICKNESS OF BASE

NOM CONTACT HT OF PKG. MEASURED ALONG THE CYLINDER.



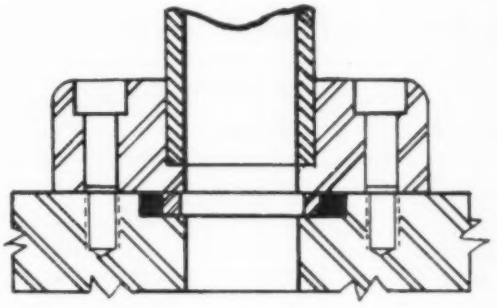
JIC STANDARD O-RING GASKET

HS—25

MATERIAL (HOMOGENEOUS RUBBER)

TYPE OF PKG (O-RING GASKET)

JIC STANDARD PART NO (EQUIV IN SIZE TO AN 6230-25)



U-PACKING, NO ADAPTERS (NON STANDARD SIZE)

LU— 3.12 X 3.87 X .12— .37

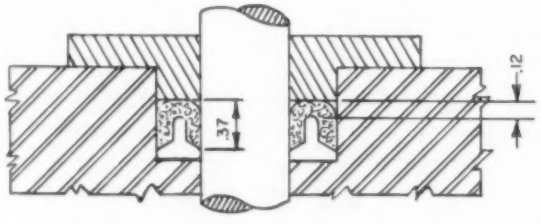
MATERIAL (LEATHER)

TYPE OF PKG (U-PACKING)

NOM I.D OF PKG.

NOM O.D OF PKG.

NOM. HEIGHT OF PACKING SET MEASURED ALONG THE ROD.



FLANGE PACKING—(NON STANDARD SIZE)

FF—.75 X 1.75 X .12—.50

MATERIAL (FABRIC REINFORCED RUBBER)

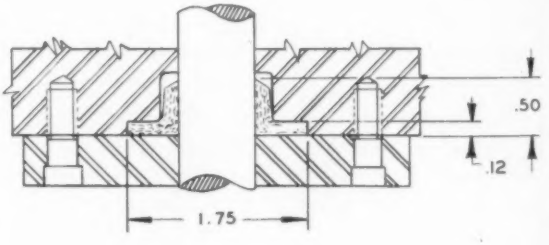
TYPE OF PKG FLANGE

NOM ROD DIA

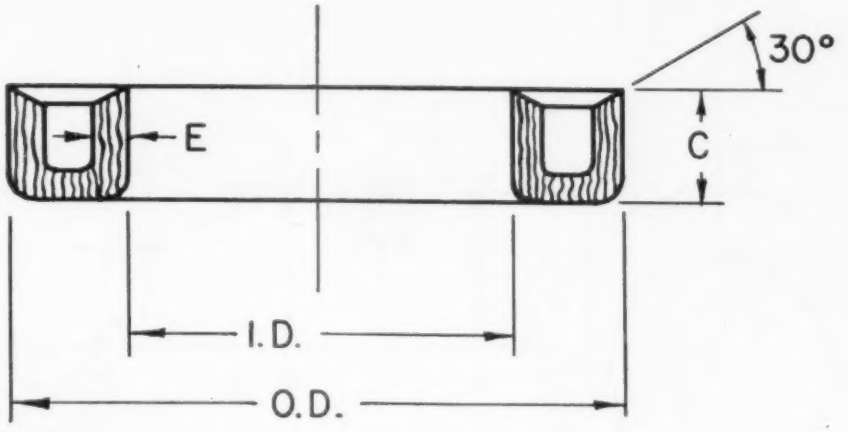
NOM OD

FLANGE THICKNESS

NOM CONTACT HT MEASURED ALONG THE ROD



NOMINAL SIZES FOR LEATHER OR HOMOGENEOUS "U" PACKINGS

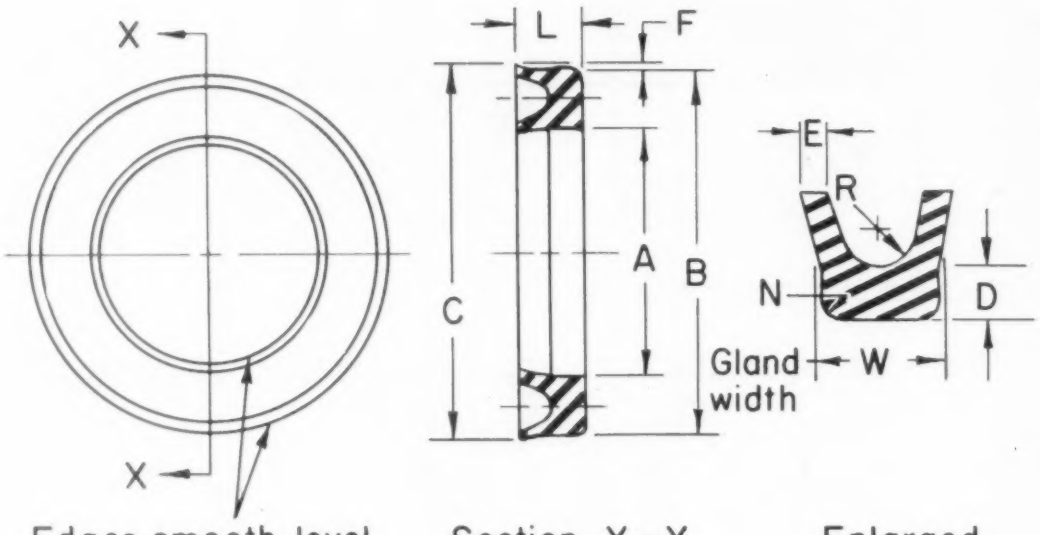


Inside Diameter	Increment	Cross Section	C
½ THRU ⅞	⅛	¼	5/16
1 " 1¾	⅛	⅜	⅜
1⅞ " 2½	⅛	½	7/16
2¾ " 3¾	¼	½	½
4 " 5½	¼	⅝	⅝
5½ " 11	½	¾	¾
12 " 15	1	¾	1
16 AND OVER	1	¾	*
* 16" TO 36" - 1¼			
* 37" & UP - 1½			

Dash No.	Cross Section	Nominal Inside Diameter	Nominal Outside Diameter	C	E
12	¼	½	1	5/16	1/16
14	¼	⅝	1⅛	5/16	1/16
16	¼	¾	1¼	5/16	1/16
18	¼	⅞	1⅜	5/16	1/16
20	⅜	1	1¾	⅜	3/32
22	⅜	1⅛	1⅞	⅜	3/32
24	⅜	1¼	2	⅜	3/32
26	⅜	1⅜	2⅛	⅜	3/32
27	⅜	1½	2¼	⅜	3/32
28	⅜	1⅝	2⅜	⅜	3/32
29	⅜	1¾	2½	⅜	3/32
30	½	1⅞	2⅞	7/16	⅛
31	½	2	3	7/16	⅛
32	½	2⅛	3⅛	7/16	⅛
33	½	2¼	3¼	7/16	⅛
34	½	2⅜	3⅜	7/16	⅛
36	½	2½	3½	½	⅛
38	½	2¾	3¾	½	⅛
40	½	3	4	½	⅛
42	½	3¼	4¼	½	⅛
44	½	3½	4½	½	⅛
46	½	3¾	4¾	½	⅛

Dash No.	Cross Section	Nominal Inside Diameter	Nominal Outside Diameter	C	E
49	⅝	4	5¼	⅝	5/32
50	⅝	4¼	5½	⅝	5/32
51	⅝	4½	5¾	⅝	5/32
52	⅝	4¾	6	⅝	5/32
53	⅝	5	6¼	⅝	5/32
54	⅝	5¼	6½	⅝	5/32
55	⅝	5½	6¾	⅝	5/32
56	¾	5½	7	¾	5/32
58	¾	6	7½	¾	3/16
60	¾	6½	8	¾	3/16
62	¾	7	8½	¾	3/16
64	¾	7½	9	¾	3/16
66	¾	8	9½	¾	3/16
67	¾	8½	10	¾	3/16
68	¾	9	10½	¾	3/16
69	¾	9½	11	¾	3/16
70	¾	10	11½	¾	3/16
71	¾	10½	12	¾	3/16
72	¾	11	12½	¾	3/16
74	¾	12	13½	1	3/16
76	¾	13	14½	1	3/16
78	¾	14	15½	1	3/16
80	¾	15	16½	1	3/16

NOMINAL SIZES FOR HOMOGENEOUS U-CUP PACKINGS



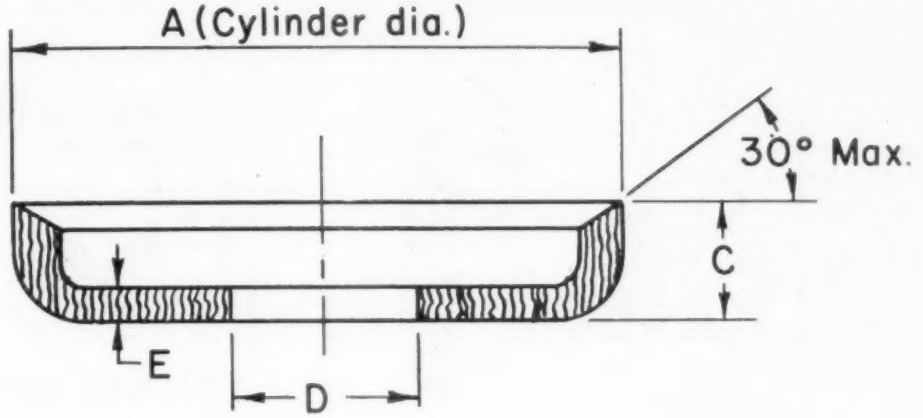
Edges smooth, level and free of flash

Section X—X

Enlarged section

Dash No.	W & L	Nominal Size		Diameter ± .005			D	E	F	R	N
		I. D.	O. D.	A	B	C					
8	1/4	1/4	3/4	.265	.735	1/2	3/32	.045	.030	.070	1/32
10	1/4	3/8	7/8	.390	.860	5/8	3/32	.045	.030	.070	1/32
12	1/4	1/2	1	.515	.985	3/4	3/32	.045	.030	.070	1/32
14	1/4	5/8	1 1/8	.640	1.110	7/8	3/32	.045	.030	.070	1/32
16	1/4	3/4	1 1/4	.765	1.235	1	3/32	.045	.030	.070	1/32
18	1/4	7/8	1 3/8	.890	1.360	1 1/8	3/32	.045	.030	.070	1/32
20	1/4	1	1 1/2	1.015	1.485	1 1/4	3/32	.045	.030	.070	1/32
22	1/4	1 1/8	1 5/8	1.140	1.610	1 3/8	3/32	.045	.030	.070	1/32
24	1/4	1 1/4	1 3/4	1.265	1.735	1 1/2	3/32	.045	.030	.070	1/32
25	5/16	1 1/4	1 7/8	1.265	1.860	1 9/16	1/8	.050	.032	.093	1/32
26	5/16	1 3/8	2	1.390	1.985	1 11/16	1/8	.050	.032	.093	1/32
27	5/16	1 1/2	2 1/8	1.515	2.110	1 13/16	1/8	.050	.032	.093	1/32
28	5/16	1 5/8	2 1/4	1.640	2.235	1 15/16	1/8	.050	.032	.093	1/32
29	5/16	1 3/4	2 3/8	1.765	2.360	2 1/16	1/8	.050	.032	.093	1/32
30	5/16	1 7/8	2 1/2	1.890	2.485	2 3/16	1/8	.050	.032	.093	1/32
31	5/16	2	2 5/8	2.015	2.610	2 5/16	1/8	.050	.032	.093	1/32
32	5/16	2 1/8	2 3/4	2.140	2.735	2 7/16	1/8	.050	.032	.093	1/32
33	5/16	2 1/4	2 7/8	2.265	2.860	2 9/16	1/8	.050	.032	.093	1/32
34	5/16	2 3/8	3	2.390	2.985	2 11/16	1/8	.050	.032	.093	1/32
35	5/16	2 1/2	3 1/8	2.515	3.110	2 13/16	1/8	.050	.032	.093	1/32
36	3/8	2 1/2	3 1/4	2.515	3.235	2 7/8	1/8	.054	.035	.125	3/64
38	3/8	2 3/4	3 1/2	2.765	3.485	3	1/8	.054	.035	.125	3/64
40	3/8	3	3 3/4	3.015	3.735	3 3/8	1/8	.054	.035	.125	3/64

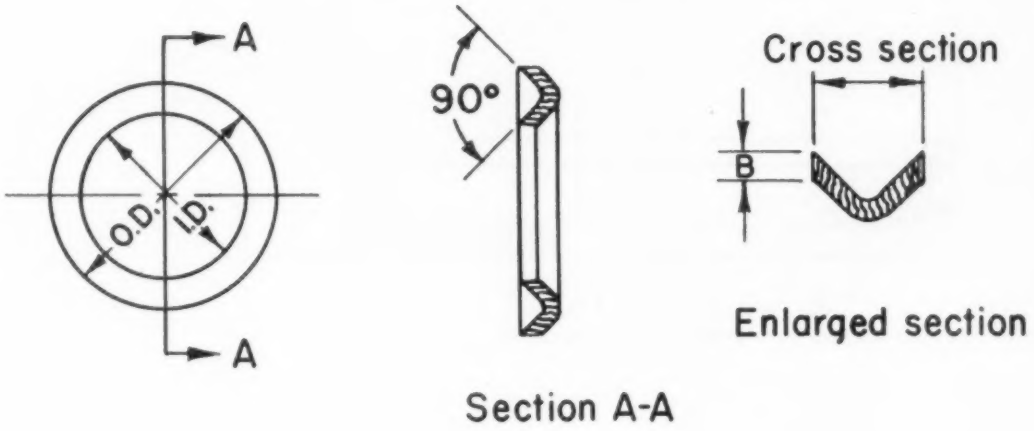
NOMINAL SIZES FOR LEATHER CUP PACKINGS



Dash No.	A	C Max.	D	E Min.	E Max.
1	7/16	¼	To Suit	1/32	1/16
2	½	¼	"	1/32	1/16
3	9/16	¼	"	1/32	1/16
4	⅝	9/32	"	1/32	3/32
5	11/16	9/32	"	1/32	3/32
6	¾	5/16	"	1/32	3/32
7	13/16	5/16	"	1/32	3/32
8	⅞	⅜	"	1/32	3/32
9	15/16	⅜	"	1/32	3/32
10	1	½	"	1/16	⅛
11	1⅛	½	"	1/16	⅛
12	1¼	½	"	1/16	⅛
13	1⅜	½	"	1/16	⅛
14	1½	½	"	3/32	⅛
15	1⅝	½	"	3/32	⅛
16	1¾	½	"	3/32	5/32
17	1⅞	½	"	3/32	5/32
18	2	½	"	3/32	5/32
19	2⅛	½	"	3/32	5/32
20	2¼	½	"	3/32	5/32
21	2⅜	½	"	3/32	5/32
22	2½	½	"	3/32	5/32
23	2⅝	½	"	3/32	5/32
24	2¾	½	"	3/32	5/32
25	2⅞	½	"	3/32	5/32
26	3	⅝	"	⅛	3/16
27	3⅛	⅝	"	⅛	3/16
28	3¼	⅝	"	⅛	3/16
29	3⅜	⅝	"	⅛	3/16
30	3½	⅝	"	⅛	3/16

Dash No.	A	C Max.	D	E Min.	E Max.
31	3⅝	⅝	To Suit	⅛	3/16
32	3¾	⅝	"	⅛	3/16
33	3⅞	⅝	"	⅛	3/16
34	4	⅝	"	⅛	3/16
35	4¼	⅝	"	⅛	3/16
36	4½	⅝	"	⅛	3/16
37	4¾	⅝	"	⅛	3/16
38	5	¾	"	⅛	3/16
39	5¼	¾	"	⅛	3/16
40	5½	¾	"	⅛	3/16
41	5¾	¾	"	⅛	3/16
42	6	¾	"	⅛	3/16
43	6¼	¾	"	⅛	3/16
44	6½	¾	"	⅛	3/16
45	6¾	¾	"	⅛	3/16
46	7	¾	"	⅛	3/16
47	7¼	¾	"	⅛	3/16
48	7½	¾	"	⅛	3/16
49	7¾	¾	"	⅛	3/16
50	8	1	"	⅛	3/16
51	8½	1	"	⅛	3/16
52	9	1	"	⅛	3/16
53	9½	1	"	⅛	3/16
54	10	1	"	⅛	3/16
55	10½	1¼	"	⅛	3/16
56	11	1¼	"	⅛	3/16
57	11½	1¼	"	⅛	3/16
58	12	1¼	"	⅛	3/16

NOMINAL SIZES FOR LEATHER OR HOMOGENOUS "V" PACKINGS



Dash No.	Cross Section	Nominal Inside Diameter	Nominal Outside Diameter	B ±.010
8	¼	¼	¾	.083
10	¼	⅜	⅞	.083
12	¼	½	1	.083
14	¼	⅝	1⅛	.083
16	¼	¾	1¼	.083
18	¼	⅞	1⅜	.083
20	¼	1	1½	.083
22	¼	1⅛	1⅝	.083
24	¼	1¼	1¾	.083
25	5/16	1¼	1⅞	.140
26	5/16	1⅜	2	.140
27	5/16	1½	2⅛	.140
28	5/16	1⅝	2¼	.140
29	5/16	1¾	2⅜	.140
30	5/16	1⅞	2½	.140
31	5/16	2	2⅝	.140
32	5/16	2⅛	2¾	.140
33	5/16	2¼	2⅞	.140
34	5/16	2⅜	3	.140
35	5/16	2½	3⅛	.140
36	⅜	2½	3¼	.156
38	⅜	2¾	3½	.156
40	⅜	3	3¾	.156
42	⅜	3¼	4	.156
44	⅜	3½	4¼	.156

Dash No.	Cross Section	Nominal Inside Diameter	Nominal Outside Diameter	B ±.010
46	⅜	3¾	4½	.156
49	7/16	4	4⅞	.197
50	7/16	4¼	5⅛	.197
51	7/16	4½	5⅜	.197
52	7/16	4¾	5⅝	.197
53	7/16	5	5⅞	.197
54	7/16	5¼	6⅛	.197
55	7/16	5½	6⅜	.197
56	½	5½	6½	.197
58	½	6	7	.197
60	½	6½	7½	.197
62	½	7	8	.197
64	½	7½	8½	.197
66	½	8	9	.197
67	½	8½	9½	.197
68	½	9	10	.197
69	½	9½	10½	.197
70	½	10	11	.197
71	½	10½	11½	.197
72	½	11	12	.197
74	½	12	13	.197
76	½	13	14	.197
78	½	14	15	.197
80	½	15	16	.197

St. Louis ASTE'ers, left, turn from golf to softball as they choose up sides for a game on their annual outing at Cre

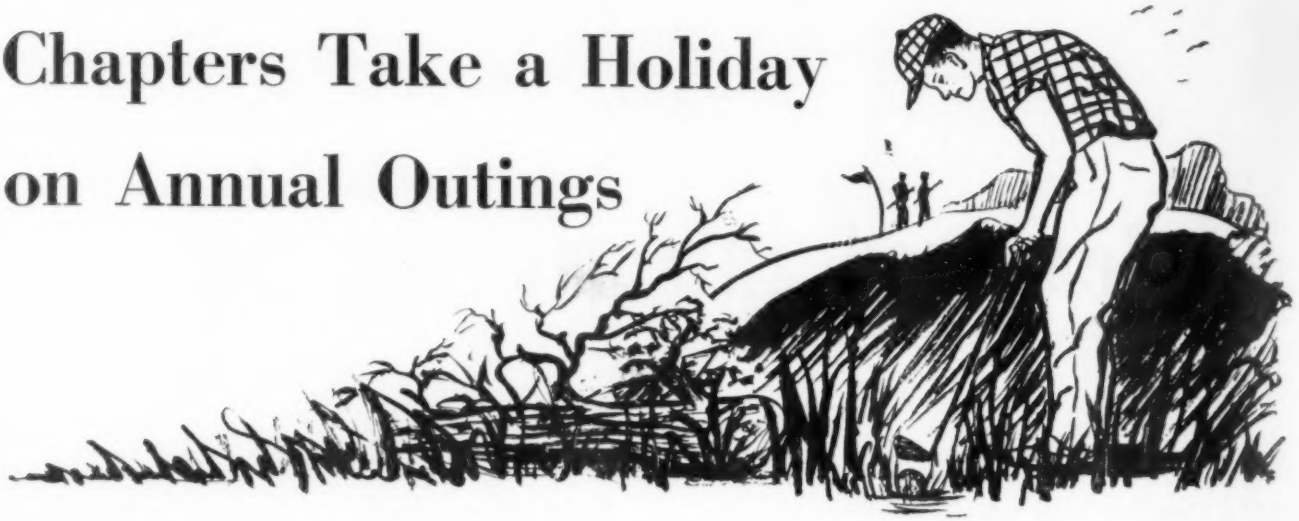
news

featured this month . .

St. Louis ASTE'ers, left, turn from golf to softball as they choose up sides for a game on their annual outing at Creve Coeur Farmers' Club. Visored caps protect heads from intense sun rays in 100 degree heat.

Discussing the possible scoring outcome of members who turned out for the Chicago golf outing on June 6 are John Beck, first vice chairman, and Tom Barber, member of National Program Committee.

Chapters Take a Holiday on Annual Outings



Talk turned to baseball standings of the home town teams when these St. Louis rooters got together between innings of their own ball game.

This contented looking ASTE group attended the New Haven chapter picnic held at the summer home of Frank Gilbert. Golf, horseshoes, quoits, and baseball occupied the athletically-inclined members. Hot dogs and hamburgs cooked on charcoal grills satisfied ravenous appetites.

Hot and Humid

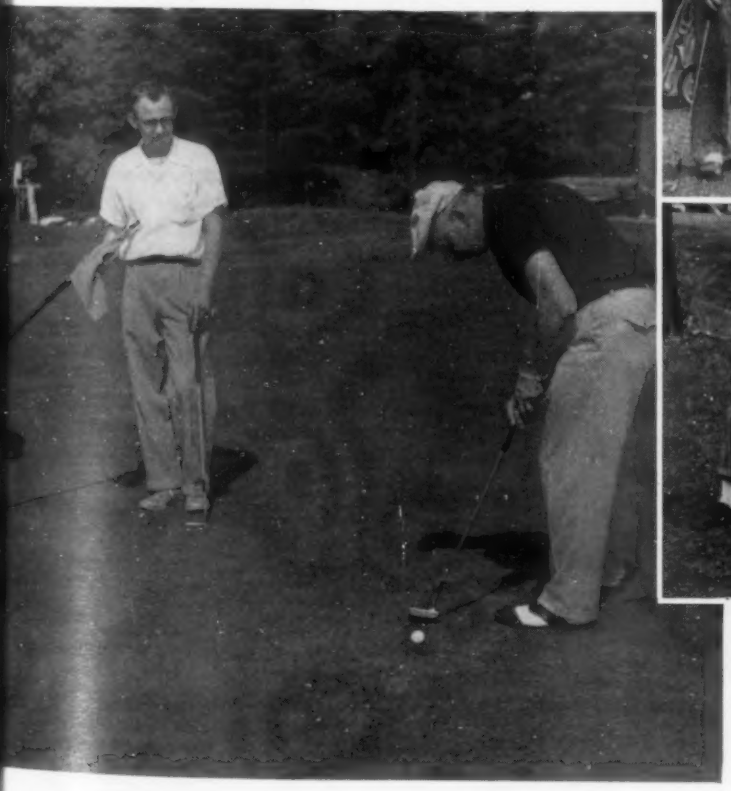
St. Louis Outing

These Rockford golf enthusiasts weren't missing on the links when the annual stag contest was held June 11. Taking a breather are: R. Sheldon, R. Knudson, R. Johnson, and William Moreland, Rockford chapter chairman.

Members of the first foursome to tee off in the Los Angeles annual golf tournament reveal both confidence and optimism for a successful day on the green. Low scores are anticipated by: Al Baker, guest; Ralph Chrissie, National Program Committee; Eddie Riddle, first vice chairman; and Carl Weitzel.

Smiles crease the faces of Chicago ASTE'ers Fred Schmitt, national director, Bob Rollin, Norm Fagerson, and Verne Loeppert, past chairman.

Dave Matthewson makes sinking a putt look easy for New Haven members Speidel and Mayer.



Another quintet in the Rockford tourney, from Ehret and Kinsey, Chicago, relaxes long enough to be snapped for posterity. Looking pleased with the day's scores are: Leonard Johnson, smoke-glassed spectator, John Kinsey, Henry Anderson, Marshall Olson and Pete Cassaro.

Hot and Humid

St. Louis Outing Gets Attendance of 400

St. Louis—Temperatures that soared over the 100 degree mark proved to be no barrier to the success of St. Louis chapter's sixteenth annual outing held June 20 at Creve Coeur Farmers' Club. Well over 400 members and their guests were present for a full program of baseball, contests and an outstanding picnic.

For the second time, Willis J. Potthoff guided the Emerson Electric baseball team to the softball championship in the traditional contest between chairmen and first vice chairmen. The corkball championship was won by General Metal Products Corp., managed by Harold Oberle.

The horseshoe tournament saw L. Hellman get top honors in the singles and Ralph Kuehnel and Joe Shell in the doubles. Each member of the winning teams was presented with a bronze plaque, a replica of the state of Missouri with the ASTE emblem superimposed on the upper left-hand corner.

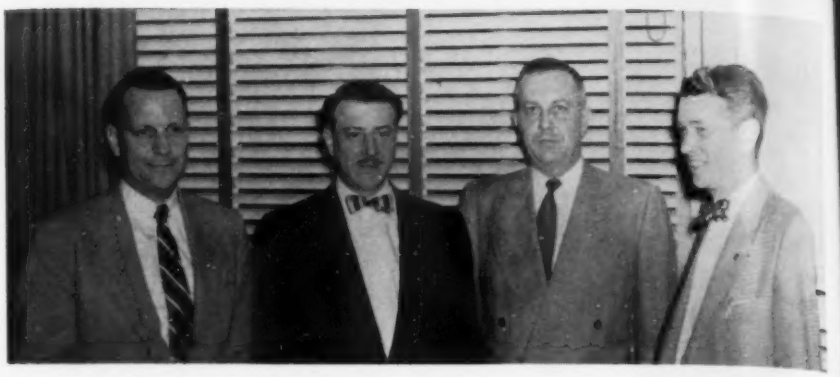
This award, made and designed by Chairman W. J. Potthoff, was given to each St. Louis contest winner.

Special awards were made to Eddie Doogan, charter charman of the chapter; J. J. Demuth, past national president of the Society; and Willis Ehrhardt, now a national director of ASTE. Other awards went to Erv Huchzermeier and Bill Bachman for their service to the chapter in the past years.

Members from chapters in Springfield, Ill., Evansville, Nebraska and Kansas City traveled to St. Louis for the outing. Chairmen of the entertainment committee was Gene Voigt.

Earlier in June the chapter held its annual ladies' night at the DeSoto Hotel. Attended by more than 350 members and their guests, the program featured a dinner dance in the ballroom and an entertaining talk by Leonard Hall, writer and lecturer on nature lore.

—Elmer Graser



Joseph P. Crosby, far left, first vice president of the Society, was a featured speaker at the May meeting of the Louis Joliet chapter. He presented a discussion of future plans and national activities of ASTE. The technical talk was made by James Dopp, second from left, sales manager, Lapointe Machine Tool Co., Hudson Mass., who spoke on modern broaching methods. Others pictured are Mr. Travis and Chairman Harry Moffat. *—Clifford Berglund and H. E. Frier*

American Machine & Foundry Co. Speaker Addresses Long Island ASTE Members

Long Island, N.Y.—A crowded schedule of activities was recorded in May and June by members of the Long Island ASTE chapter. On June 9 the chapter met for its first dinner session and heard a talk on automatic machines given by Carl W. Johnson, assistant general manager of the stitching division of American Machine & Foundry Co.

Mr. Johnson, using slides for illustration, described the first automatic machine made by his company and progressed to the most recent models that handle such operation as bread slicing and wrapping, cigaret manufacturing, sugar wrapping and cake mixing.

He showed a number of excellent machines which the public refused to accept and explained where the criticisms were justified. Accessibility of the internal machinery for necessary maintenance and simplified design were stressed as was economy in operation.

A guest at the meeting was Eugene Roth, past chairman of the Greater New York chapter. A *Tool Engineers Handbook* was awarded to Al Seward. Of major interest during the business session at the meeting was the announcement that chapter members now number 472, making Long Island largest in ASTE.

On May 11 Long Island members heard Dr. Leo Tarasov of the Norton Grinding Co. speak on "Important Factors in Grinding Hardened Steels." He launched his talk with a review of the theory of grinding and, using graphs to illustrate important points, discussed the grindability of metals.

Ray Huntington, left, retiring chairman of Long Island's Student Chapter, congratulates Rudy Ramcke on his election to the 1953-54 chairmanship.

Members of the Long Island student chapter held their annual picnic May 9 at Chateau Goudreau in Wyandanoh, Long Island. Various games and contests were scheduled, with Al Kane, Hope Rostrom, Chet Walker and Dick Schlectig winning top honors for their skill. On hand for the clambake were Chairman Arthur Cervenka and Mrs. Cervenka. Sal Silvestri was in charge of the event and John Schulz handled the cook's duties.

The last regular meeting of the season for student ASTE members on May 5 featured the election of Rudy Ramcke as chairman and Ken Scheel as treasurer. Other officers will be named in September when the whole slate is installed. The technical session was presented by H. H. Stobe and Irwin Lieberman of DoAll.

—Sara T. Moxley

Mid-Hudson Schedules Fall Refresher Course

Through the efforts of the education and professional engineering committees of the Mid-Hudson chapter, plans are being made for a basic engineering course to provide members with an opportunity to improve their technical knowledge and prepare for professional engineering examinations. To date, more than 60 men have registered for the initial phase of the course which begins in September.

Subjects to be covered include analytical mechanics, strength of material, structures, mechanics of fluids, thermodynamics, electricity, economics and a number of special topics.

L. H. Tenney, chairman of the professional engineering committee, and Morgan Newberry, chairman of the education committee are formulating the course with the assistance of C. J. Noll, John Peale, Richard Fitzgibbons, J. H. Keller, J. E. Thorpe, John Petz, H. G. DePew and Chapter Chairman Stanley P. Cook.

—E. W. Nielsen

Committee Chairman Guest of Wichita Chapter

Wichita — Ed Ruder, chairman of the National Public Relation Committee, was a guest speaker at the June 17 meeting of the Wichita chapter. He congratulated the group for its rapid growth in membership and made special mention of the spirit and enthusiasm of the chapter officers.

The technical lecture was made by F. E. Sebring, sales manager, Hydraulic Press Mfg. Co., Mount Gilead, Ohio. His topic was "Hydraulic Press Applications in the Aircraft Industry."

Diagrams of press plumbing and valving for hydraulic fluids showed how dangerous vibration can be dampened by proper control of pressures. Film strips presented schematic diagrams helpful to both press operators and aircraft tool engineers.

—John G. Temple

Obituary

Herbert M. Traub, member of the Indianapolis ASTE chapter, died on May 29. He was a drafting instructor at one of Indianapolis' largest schools, Arsenal Technical High School and at one time had been associated with Ace Engineering Co.

Donald Wernz, left, chairman of the Baltimore ASTE chapter, welcomes J. J. Demuth, 1951-52 president of the American Society of Tool Engineers, to the podium at the May meeting. Mr. Demuth spoke on future plans and activities of the Society.

Baltimore Hears Past President

Baltimore—J. J. Demuth, ASTE's past president, was a special guest at the May meeting of the Baltimore chapter. Mr. Demuth briefed the members on the Society's financial status and described ASTE's future plans and activities.

A technical session followed with a talk by E. Von Hombach, research and development engineer of the Carpenter Steel Co. of Reading, Pa. He gave his listeners tips on duplication and fabrication of stainless steel. After a discussion period, members had ample opportunity to examine samples of stainless steel parts.

—C. G. Kelley

Tornado Hits Plant One Week Later

Worcester, Mass. — A plant tour was in order for the members and guests of the Worcester chapter at their June meeting. They viewed the new six-million dollar Norton Grinding Plant, ate dinner in the plant cafeteria, and heard a talk by a plant official.

The night's speaker was Iver G. Freeman, factory manager of the grinding division. He discussed the methods of production and advantages of the new plant which was built for straight-line production. Mr. Freeman has been with Norton Co. for 38 years and has improved methods of precision grinding and lapping machine procedure.

The tour was well-timed. Exactly one week later, a tornado, which raged through central Massachusetts, left its mark on the new plant. Damages were estimated at one million dollars.

—Alvin H. Shairman

Wason and Abbott Join *Tool Engineer* Staff

Two appointments to the editorial staff of THE TOOL ENGINEER have been announced by John W. Greve, editor of the magazine. Robert A. Wason has been named associate editor, replacing Robert T. Kimmel who resigned to do free lance writing, and Alfred K. Abbott has been appointed to the newly created position of assistant editor.

Mr. Wason, a mechanical engineering graduate of Stevens Institute of Technology, is a former eastern representative for Hill & Knowlton, Cleveland publicity and public relations firm. He was associated with McGraw-Hill as news editor on *Product Engineering*, and later helped to establish *Purchasing News* for Rogers Publishing Co. while serving as *Design News'* eastern editor. He has written a number of free lance articles for several other technical magazines, including *Electrical Manufacturing*.

Abbott

Wason

Mr. Abbott is a graduate of Michigan State College where he majored in industrial journalism. Before attending college, he served with the U.S. Navy and spent eight years as a journeyman tool and die maker with several Michigan firms, including the Ford Motor Co., Beach Engineering Co., and Oldsmobile Division of General Motors Corp. He is a member of Pi Alpha Mu, journalism fraternity.

Di Eugenio Moves into New Phoenix Office

John Di Eugenio, Phoenix ASTE member and representative for a number of eastern companies, recently moved to offices he designed and built at 119 South 11th Ave. in Phoenix. Mr. Di Eugenio is an exclusive representative in the states of Arizona, New Mexico and Colorado for John Bath & Co., Federal Products Corp., Circular Tool Co., Ready Tool Co., Producto Machine Co., McCrosky Tool Corp., Lovejoy Tool Co., and Weldon Tool Co. He also has a Denver office located at 2913 East Colfax Ave.

First Annual Outing Scores Success in Lima

Lima, Ohio—The first annual outing was staged June 20 by some 50 members gathered at Lost Creek Country Club for a day of golf, horseshoe, card games and a picnic.

Winners of the various events were: (horseshoes) singles, Herbert Kunkelman and Rex Nutter; doubles, Bob Mercer, George Paptzun, Buddy Stuckey, John F. Hess; elimination contest, Leroy B. Heyne, Louis Heyne, John Kuch, Michael Berthold; kickers prizes, Ray Schimpf, Bill Harruff, Gene Stumpp and Evan Feightner.

Golfing honors went to Alex Daniels, Wilbur Brillhart, Ed Gaffney, Dick Shaw, Buck Cramer, Andy Sousz and Gene Siferd.

The day's program was planned by Bill Eppley and Jim Day.

—Donald Cox

Annual Picnic Attended by 300

Danial's Farm was the scene of the annual picnic held by the Pittsburgh chapter No. 8 and their friends. Over 300 members, their families and friends competed for prizes in the varied program of sports and games.

One member won a rod and reel for being most adept at casting a plug into a bucket from 75 feet while other members carried home such prizes as an electric toaster, a coffee maker and a radio as tribute to their skills.

Old-fashioned fried chicken highlighted the menu and was supplemented by food served at the snack bar.

—E. L. Caughey

Lima unanimously selected William Epley for its merit service pin for his fruitful efforts as membership chairman. Ray Schimpf makes the award.

Chapter Sees Farm Machinery in the Making

New Holland—Members and guests of the Greater Lancaster chapter of the Society met at the New Holland Machine Division of the Sperry Corp. on June 16. T. Coy welcomed the ASTE visitors and Ray Moorehead outlined the program for the coming year.

Frank Seyl, plant manager of the Holland Machine Division told the history of the company and described its various products.

Recent developments in farm machinery were observed in two films: "Green Promise" and "New Holland Newsreel." Company representatives then escorted the group on a tour of the plant to see the New Holland "Automatic" Hay Balers in the making. The tour included all phases of manufacture from fabrication of sheet metal parts, machining of intricate gears, to final assembly.

—George J. Coil

Members of Greater Lancaster chapter were privileged to tour New Holland Division of the Sperry Corp. in June. A group inspects recent developments in farm machinery. Among observers are: John R. Folkerson; Solomon S. Gipe; and Joseph H. Resser, Sr. About 80 participated in the visitation.

Arc Machining Reviewed by Evansville Chapter

Evansville—Three talks were on the agenda at the June meeting of the Evansville chapter at Hadi Shrine Temple. The 65 members in attendance heard Mr. Charles Woods, administrative director of the Vanderburgh County Civil Defense Council, speak on "Survival under Atomic Attack" during the coffee hour.

The program chairman for the evening was Ed Gentry, of State Machinery Co. He introduced Mr. Robert Owens who gave a talk entitled "Today's Method of Arc Machining," who, in turn, introduced Victor Matulaitis with the futuristic view in his talk, "Arc Machining in the World of Tomorrow."

The meeting was adjourned and members went on a tour of Benerson Corp. (a local tool shop) for a first-hand demonstration of Mr. Owens' talk.

—Bill Gaines

Donovan to Attend Anniversary Meeting

San Fernando Valley chapter's first anniversary will be celebrated August 5 when members and their wives meet at Hody's Restaurant in North Hollywood for a special program. Thomas J. Donovan, a past director of the Society, will be a special guest and will conduct his well-known quiz for the California audience. A talk by an industrialist from Brazil and a showing of a sound film from Alcoa are also scheduled.

During its first 12 months, the San Fernando chapter has scored a rapid and steady growth. Membership now stands at 300 and future plans indicate more members will be brought into the organization in the second year of activity.

—C. D. Colvey

Two Speakers Address Meeting in Bridgeport

Bridgeport, Conn.—Fairfield County chapter's June meeting was highlighted by the presentation of a new banner for display at meetings by Mason Whiting, past chairman of the chapter. Ten new members were awarded pins.

Two speakers addressed the group from V and O Press, Division of Emhart Mfg. Co. of Hudson, N.Y. They were William W. Schug, sales manager, and R. A. Freeman, chief engineer. Sound films and slides were presented on press capacities and presses geared for automatic production.

—Robert Brechter

Manufacturing Processes Studied on ASTE Tours

Seattle chapter members, 127 strong, were guests at the Structural Steel Fabrication Plant of the Pacific Car and Foundry Co. for their April meeting. Arrangements for the tour were made by Dell Nunn and Clarence Downie.

Chairman Roy A. Coady, directly behind handle, and a group of ASTE'ers watch a saw cutting through an I-beam. Other operations witnessed included automatic torch cutting, jig welding, and multiple drilling.—*C. R. F. Carlson*

Some of the 65 Evansville chapter members, who attended the June meeting, huddle up closer to get a better view of a demonstration on arc machining. They are watching Robert Owen, center, field engineer with Elox Corp., Clawson, Mich., who is showing them how it's done. Ed Gentry, program chairman, arranged the tour at Benerson Corp. (a local tool shop).

As a climax to Detroit chapter's successful 1952-53 social-technical meetings, members were taken on an extensive plant tour at Willey's Carbide Tool Co., in Detroit. The marvels of carbide chemistry and the manufacture of tungsten carbide metals and tools were of interest to all. Seen left to right are: John Kennedy, Vic Krajewski, and Joe Cott, all of Willey's; F. H. Willey, Jr., president and director of the company; Sy Currier; the master mechanic; and Charlie Franz.
—*Walter Schober*

Photo by E. J. Kane

Harry Conn, far left, chief engineer, for Scully-Jones & Co., Chicago, spoke at the June meeting of the Springfield, Ill., chapter. His discussion of "Production and Tooling Problems" was heard by 50 members and their guests. Shown with Mr. Conn, from left, are: John Javorsky, Earl J. Kane, and Paul Dirksen.

Henry Sharpe Speaks at Hartford Night

The traditional Hartford Night program, the seventeenth to be held by the Hartford ASTE chapter, was held this year on June 8 at the Hotel Bond. A number of distinguished guests were present to help make the yearly event a success.

Principal speaker was Henry J. Sharpe, Jr., president of Brown & Sharpe Mfg. Co. He spoke to the ASTE audience on "Replace Formulas — Help or Headache?" His speech is covered on page 43 in the technical section of this issue of THE TOOL ENGINEER.

Roger F. Waindle, national president of the Society, extended ASTE's greetings to the group. Toastmaster was A. J. d'Arcambal, past president of the Society and charter chairman of the Hartford chapter. Presiding officer was Omer A. Gingras, 1953-54 chairman of the chapter.

Guests included: Harry E. Conrad, executive secretary of ASTE; Ray H. Morris and Irwin F. Holland, past presidents; Richard A. Smith, director-elect; Joseph V. Cronin, mayor of the city of Hartford; and representatives from nearly 30 eastern industrial firms.

The banquet was preceded by a reunion hour. Both were held in the Bond Ballroom. Arrangements were directed by Arnold Lormore, Robert Strauss, Howard Wheeler, Grant Smedley and Robert Kipax.

Peoria Lab's Part in Penicillin Research Told

Peoria—K. R. Majors, technical assistant to the director, Northern Regional Research Laboratory, was the guest speaker at the Peoria meeting. His talk was introduced by Victor W. Schellschmidt, first vice chairman of the chapter. In Mr. Majors' speech entitled "Activities of a Research Laboratory," he told of recent medical developments from the use of farm products, and gave a history of the part played in the development of penicillin by the Peoria laboratory.

More than 150 members and guests were present for the June technical session and business meeting.

The past month saw the initiation of seven new members: Frank Walther, James Wells, Richard Davis, James Eskman, Hugh Kennedy, John Meyor, and Donald Wookcock.

The chapter will have a new program chairman when Richard Streitmiller is transferred to York, Pa. Edward Weber, tool engineer at Caterpillar Tractor Co., will fill his vacancy on the executive committee.

—Russ Sears

Family Picnic Draws Large Mid-Hudson Crowd

Poughkeepsie — In spite of rainy weather, more than 400 Mid-Hudson members and their guests turned out June 13 for the seventh annual family picnic held at Shadybrook Park. Many prizes were awarded to the winners of various contests. Traditional picnic fare served throughout the afternoon was topped off with a roast-beef dinner.

—E. W. Nielsen

Following his talk on "Hydroforming" made at a recent meeting of the Kansas City chapter, Kenneth P. Martin, center, shows samples to William Brown, left, and Harlan Printz, both from Westinghouse Aviation Gas Turbine Division. ASTE members also heard a talk by Charles M. Clark. Both speakers are associated with Cincinnati Milling.

Peoria ASTE members met at the Pabst Co. in Peoria Heights for their June technical session. From left: Carl Kemp, Clarence Schafer, K. R. Majors, who addressed the group, John Bacon, Jesse Boice and Carl Smith. Mr. Majors is technical assistant to the director of Northern Regional Research Laboratory. *Photo by R. W. Corliss*

Golden Gate's annual dinner dance featured wide smiles. At the head table: Ralph Moller, editor, *Western Machinery and Steel World*; Paul Pick; L. Dean Rouland, first vice chairman; Mrs. Rouland; Dave Gustafson, chairman; Mrs. Gustafson; Ted J. Rohrer, past chairman; Mrs. Rohrer; Vernon Gallichotte, second vice chairman; and Mrs. Gallichotte.

Tillotson Returns to Delco Products Division

Featured news of the Dayton ASTE chapter includes the recent return of George Tillotson from service with the Metalworking Equipment Division of the National Production Authority in Washington, D.C. Mr. Tillotson was loaned to the government by Delco Products Division.

Chautauqua-Warren Hears Vice President

Warren, Pa. — Electronics was the main topic of Chautauqua-Warren, chapter No. 108 at their June meeting. After a social hour and a dinner, the members enjoyed an informative talk by S. A. Brandenburg, vice president of sales at Monarch Machine Tool Co., Sidney, Ohio. His topic was "Latest Developments in the Turning Field."

He explained the use of electronics as an innovation in turning machine application. The presentation included three films: "Monarch Air Gage Tracer," "Pattern for Profit," and "The Speedi-Matic Hand Screw Machine." The use of electronics was illustrated in the fact that speed was automatically reduced or increased to maintain constant surface speed in proportion to diameters.

—Lawrence R. Green

The Millers and Blairs Are Well-Known in Dayton

Two family combinations have occupied Dayton chapter's highest office during the past ten years. J. D. Blair served as chairman in 1943-44 and his son, R. M. Blair, headed the chapter in 1952-53. The present chapter chairman, R. A. Miller, was preceded by his brother, C. R. Miller, who was elected for 1950-51.

Lecturer Discusses Dynamic Balancing

DePere, Wis.—A dinner meeting gave members of Fond du Lac No. 45 an opportunity to hear Werner I. Senger, vice president for balancing, Gisholt Machine Tool Co., Madison, Wis. His talk, "Static and Dynamic Balancing," also reached the ears of special guests, E. C. Helmke, chairman of the Madison chapter and G. M. Class, vice president for engineering, both of Gisholt Co.

Six past chapter chairmen were present: Gideon Kane, Green Bay; L. J. Kaufman, Manitowoc; William E. Rutz, Fond du Lac; J. P. Schommer, De Pere; William H. Jorrgensen, Green Bay, and Paul V. Rohling, Sheboygan. *—Robert M. Hanson*

Two Lectures Fill Kansas City Program

Kansas City — Two representatives from Cincinnati Milling and Grinding Machine Co. presented the technical program at the May 6 meeting of the Kansas City chapter. They were Charles M. Clark, assistant to the vice president in charge of sales, and Kenneth P. Martin, assistant manager of the machinery division.

In his talk on "The American System and Tools," Mr. Clark outlined the history of tools and said the number of trades has increased from 315 to 5,000 in the last hundred years, with a corresponding increase in the number of tools. He told how better tools make possible wider distribution of today's luxuries and tomorrow's necessities.

"The Hydroform — A New Kind of Tool" was discussed by Mr. Martin who described the developments which led to the practical applications of hydroforming in 1920. His lecture was illustrated with slides and exhibits.

—Richard W. Corliss

Golf Outing Held by Saginaw Chapter

ASTE'ers of Saginaw Valley held their annual golf outing on June 20. The setting was the Bridgeport Country Club. 125 members enjoyed the roast-beef dinner which was served at 6:30. Many prizes and gifts were awarded.

—Ben Phillips

A membership drive kick-off dinner was held in Los Alamos to spur enrollment in the chapter. The group of officers shown are laying plans for the campaign which will continue through elections in 1954. A contest plan was developed with awards offered to the members bringing in a specified number of applications. The group aims to make ASTE the best represented group in Los Alamos. Seated are: Howard H. Hawk, treasurer; Robert H. Moeller, chairman; and Joseph J. Bourne, secretary. Standing are: Virgil Brown, 2nd vice chairman; Frank Elliot, retiring chairman; William Moxley, program chairman; Norman Blezer, past chairman; Robert Kee, membership committee chairman; Robert Livingston, business manager; Herman Von Steeg, editorial and publicity chairman; and Gerald Rogers, chairman of the standards committee. Oliver Heustis, professional engineering chairman was also present but camera shy.

Coulter Steel & Forge Co. in Emeryville, Calif., was visited last spring by members of the tool engineering class sponsored by the Golden Gate chapter.

Golden Gate's Tool Engineering Course Expanded to Include Advanced Classes

Promotion of tool engineering classes for ASTE members has been a long-established activity in the Golden Gate chapter. For the past five years it has supported and sponsored an educational program for junior tool engineers in California industry as a step toward bettering the standards and technical know-how of its young men.

Classes have met twice a week for two-hour lectures or plant tours. About 20-25 graduate every 15-week semester.

Up until now only basic principles of tool engineering have been covered. However, under Wilbur D. Russell, education chairman, and Vern Gallichotte, last year's chairman, the program is growing to include an additional course in advanced tool engineering. Andrew Rylander is slated as the instructor for the new advanced course which is scheduled to start in September. There is a possibility that a tool-design course may be added shortly.

For the past three years, the instructor of the basic course had been Henry De Coursey, tool engineer with Friden Calculators in San Leandro, Calif. He was awarded the merit pin for exceptional service to his chapter and plans to continue teaching the course in the fall. *—Philip R. Freeman*

Adolphus Hotel Scene of ASTE Dinner Dance

Dallas—More than 100 members of the North Texas chapter and their wives danced to the music of Carl Baker's orchestra at the Adolphus Hotel on June 12. The event was the annual spring social and dinner dance. Strolling musicians serenaded the group during the dinner hour.

Radio and TV star, Jean Oliver, entertained the guests with several songs and First Vice Chairman C. V. "Chuck" Stevens presented the ladies with door prizes.

—F. Paul Simpson

Ladies' Night Celebrated by Lehigh Valley Chapter

Allentown, Pa.—It was party time the evening of June 19 when 60 members of the Lehigh Valley chapter and their guests attended the annual ladies' night dinner dance at the Hotel Traylor.

A reception launched the event, followed by dinner and a full evening of dancing. Music was provided by Wes Fisher and his orchestra. Community singing was led by George Savitz and the duties of the mistress of ceremonies were shouldered by Mrs. Ruth Kitzmiller.

Corsages and favors were received by all guests present. Arrangements for the program were directed by Bruce Schaller, chairman of the program committee.

—George W. Savitz

The monthly dinner meeting of the San Diego chapter at El Morocco Club featured an address by W. P. Brotherton, public relations at Ryan Aeronautical Co. Metallurgists were especially interested in his talk "High Temperature Age." From left: Harry Applegate, the first vice chairman, Mr. Brotherton, the speaker; and A. E. Crom, San Diego chapter chairman.—*William Keller*

A June dinner meeting was scheduled for the Long Beach chapter in Compton, Calif. The guest speaker, D. A. Ringis, plant manager at Chrysler, told members and guests about automotive industry developments and improvements in the last decade. An open discussion followed. Pictured are Vern Powell, program chairman; Mr. Ringis; and Carlyle Blanchard, chairman.—*J. J. Smith*

Rockford's educational committee sponsored a mechanical drawing contest in its high schools. Contestants drew, designed, or assembled a pencil sharpener. Pictured here (with their instructors at extreme left and right) are the winners. From left, Gordon De La Ronde, Walter Bunk, Ramon Champion, Walter Lewis, Educational Comm. chairman, Dennis Mullins, Richard Byrum, William Moreland, at back, Rockford chapter chairman, David Seal, Dennis Folkerts, and Al Sabin.—*Kenneth Hull*

Positions Available

CHIEF ENGINEER—Manufacturer of special multiple spindle machine tools requires supervisor of engineering. Must have extensive experience in fixture and special machine design. Position requires high degree of executive ability for administration and organization of department. Will have full responsibility for all phases of engineering design. This job requires a man with outstanding ability. Compensation possibilities are very attractive. Write full qualifications to Box 360, The Tool Engineer, 10700 Puritan Ave., Detroit 21, Mich.

FACTORY SUPERVISOR, under 35, with tool and die shop background, for plant manufacturing name plates, badges and marking products. Write to Box 334, The Tool Engineer, 10700 Puritan Ave., Detroit 21, Mich.

SALES ENGINEER for New York area. Progressive jobbing shop wants to be represented by an experienced sales engineer known to the industry. Write to Box 351, The Tool Engineer, 10700 Puritan Ave., Detroit 21, Mich.

CHEMIST—Experience in development of soluble and nonsoluble cutting fluids. Sound chemical background required. Major oil company. Metropolitan New York. Write to Box 343, The Tool Engineer, 10700 Puritan Ave., Detroit 21, Mich.

DISTRICT SALES MANAGER—Nationally known twist drill manufacturer seeks man to take charge of Detroit, Mich. office and warehouse. Good salary, all expenses, hospitalization, pension plan, etc. Must have knowledge of small tools and selling experience. Write to Box 325, The Tool Engineer, 10700 Puritan Ave., Detroit 21, Mich.

TOOL AND MACHINE DESIGNERS—One of Cincinnati's largest permanent design firms has openings in their own office for experienced machine, product and tool designers, and detailers.

Recent engineering graduates or students will also be given consideration. These are permanent positions with a substantial, stable leader in the field. We can offer top starting wages, modern working conditions, paid holidays, vacations, and other benefits. Our policies assure varied experience and unusual opportunities with a future.

New employees would be expected to settle on a permanent basis in Cincinnati. Please send resume to Cincinnati Designing, Inc., 37 W. Seventh St., Cincinnati 2, Ohio.

Positions Wanted

CANADIAN REPRESENTATION — Do you desire to capture a greater volume of business from Canadian industry? A recently established company headed by three aggressive Canadian tool engineers, with extensive production and sales experience, has capacity to represent high-grade machine tools and equipment in Canada. Write to Box 305, The Tool Engineer, 10700 Puritan Ave., Detroit 21, Mich.

TWO AGGRESSIVE SALES ENGINEERS are available for metropolitan New York and northern New Jersey area. Strong background in production cutting tools, screw machine tools, gages and toolroom equipment. Over ten years of contacts established with varied machine shops. Thorough coverage and service can be offered to a quality line. Write to Box 303, The Tool Engineer, 10700 Puritan Ave., Detroit 21, Mich.

Author Addresses San Fernando Chapter

North Hollywood—About 200 members of the San Fernando Valley chapter met June 3 to hear a talk by John Milek, research engineer with Hughes Aircraft Corp. and author of the titanium section of the ASM *Handbook*.

Since titanium is heavier than the light metals and stronger than many heavier metals, it has earned the title of "middleweight champ." Mr. Milek advised the sources and methods of recovery for this new metal, indicating the present and estimated future production. Many applications in industry were cited and practical suggestions for fabrication were given.

A film produced for Cincinnati Milling Machine Co., entitled "Cool Chips," pictured in slow motion the formation and removal of chips.

At the May technical session chapter members were brought up to date on the subject "Factors to Consider for Powdered Metal Tool Design." Program speaker was Phillip Tarr, chief engineer of the powdered metallurgy division, Kwikset Locks Inc., Anaheim, Calif. He covered aspects of powdered metal manufacturing from design to finished parts.

The coffee speaker, Sgt. A. S. Gerard, of the Los Angeles Police Dept. presented an informal discussion on some of the amusing incidents in his police work.

—*C. D. Colvey*

Madison Chapter Visits Besly-Welles Co.

Madison, Wis.—About 50 members of the Madison chapter traveled to Beloit June 18 for the final meeting of the year. They were guests of Besly-Welles for a plant tour and an outing at the company's club house on Rock River. Activities included horseshoes, golf driving and trap shooting and dinner provided by the firm.

—*A. J. Mergen*

Detroit ASTE Member Elected Vice President

John F. Haller, Detroit ASTE member, has been elected vice president in charge of engineering of Allied Products Co. Founder and president of Michigan Powdered Metal Products Co., Inc., until it was acquired by Allied in 1951, Mr. Haller will continue to direct the firm's development work from his staff position as chief of Allied's engineering and research.

Industrial Applications of Atomic Power Reviewed

Los Angeles—Robert L. Olson, chief of engineering design group, atomic energy department of North American Aviation, Inc., discussed useful applications of atomic power at the June 11 meeting of the Los Angeles chapter. The dinner and technical session, held at Scully's Restaurant, were attended by more than 200 members and guests.

Mr. Olson's address was particularly timely in light of the recent announcement by his company of the perfection of a workable atomic power plant. He demonstrated the same scale model of an atomic power plant which was recently sent to Washington, D.C. for study of government officials.

The effective use of atomic power plans and converted atomic power will have far-reaching consequences on the design and tooling industries. Special requirements necessitate the training of new design groups, keener methods analysis, and subsequently, the utilization of newer materials.

A full-length sound and color movie titled "Operation Greenhouse" showed the tests of atomic weapon devices on Eniwetok Atoll in 1951.

—Lew W. Goodwin

New Position for Binghamton Member

Philip M. Taylor, Binghamton ASTE member, has been appointed assistant to the purchasing agent at the Endicott plant of International Business Machine Co. Associated with the company since 1939, he was formerly second-shift manager of the typemaking and engraving, alphabet counter manufacturing, and ratchet counter manufacturing departments.

A Des Moines meeting featured a talk entitled "Seven Stepping Stones to Achievement." Speaker for the evening, George Huesman, of Continental Tooling Service and chairman Fred McMaster are shown.

Kirk Discusses Pneumatic Gaging

David B. Kirk, chief engineer, Moore Products Co., Philadelphia, was the program speaker at the May 28 meeting of the Keene co-chapter, Twin States affiliate. Covering his topic "Pneumatic Gaging," Mr. Kirk explained the application of an air jet to the measurement of dimensions using the familiar laws governing flow through an orifice.

He told how air jets can be incorporated into various types of gaging fixtures to solve a number of unusual, as well as some common gaging problems. Features of pneumatic gages were compared with those of other conventional measuring gages and some of the requirements associated with the use of pneumatic gages were described.

The technical session was held at Kingsbury Machine Tool Corp. Nearly 50 members and guests of the chapter attended.

—D. J. Brown

Field Day Highlights Spring Festivities

Kitchener, Ont.—Hot weather didn't wilt the enthusiasm of loyal Hamilton District chapter members who attended the annual field day at Rockaway Golf and Country Club.

"Fore" was the cry of the day and much latent ASTE golfing skill was discovered, as evidenced by the number who carried home trophies. Fred Belowitz, Web Cartwright, Ralph Fechay, S. Simpson and C. Bush shared in the prizes.

A unique "honest golfer" prize went to Thomas Dawson in the form of a live goat. Other tests of skill included dart throwing, putting, horseshoe throwing and nail-driving contests.

Spareribs and pigtails were on the dinner menu. The entertainment committee was headed by O. McIntyre.

—John Litwin

Annual Picnic Attracts Indianapolis Members

Noblesville, Ind.—Forest Park furnished the setting June 6 for the annual picnic of the Indianapolis ASTE chapter. A full program of sports, including golf and horseshoes, greeted the many members and guests who attended the event.

After an old-fashioned chicken dinner, a copy of the *Tool Engineers Handbook* was awarded to the member who had brought the most new members into the chapter since last year's picnic. A total of 43 men have joined since 1952.

Arrangements for the outing were directed by Ted Harding, chairman of the picnic committee, and Joe Huese, past chairman.

—M. B. Rosenbarger

Registration got involved as some 700 Akron tool engineers were guests of the Portage Machine Co. Company officials demonstrated assembly operation of the Portage Boring Mills, Warner-Swasey tapping machines, Springfield vertical grinders, and Sheffield thread grinders. Pictured at the right are Roger Wagner and William Jones.

Charles Cimarik, far left, greets Akron ASTE guests. Left to right: Frank Montanus, Springfield, Ohio, chairman; Andy Clark, National Membership Chairman; Herman Guy, E. W. Kuttler, and A. O. Hunt, all past chairmen of the Akron chapter; and Frank Flannery, 1953-54 chapter chairman.—*Howard B. Lowe.*

John W. Edgemond, Jr.

Santa Clara Chapter Tours Steel Company

Pittsburg, Calif.—The Columbia-Geneva Division of United States Steel Co. was visited June 16 by nearly 140 members of the Santa Clara Valley ASTE chapter. Response to the plant tour was so great a second visit was planned for July 14 so that the overflow could be accommodated.

After a turkey dinner served in administration building ASTE'ers were divided into groups of eight and conducted through the cold reduction, sheet finishing and tin finishing departments. They also toured the open hearth, rod mill and rolling mill.

At the chapter's May 18 meeting Frank P. Cavenaugh was elected to the position of first vice chairman. The dinner session was held at De Anza Hotel in San Jose. Guests included Al Minetti, past chairman of the Golden Gate chapter.

The featured lecture was made by John W. Edgemond, Jr., chief engineer, Magna Engineering Corp., Menlo Park, Calif. He described the various features of the Magna drill.

—Glenn Herreman

Shackleford Addresses Mohawk Valley Meeting

Utica, N.Y.—A talk on the latest advances in tool welding and die salvage work was given by W. W. Shackleford of Eutectic Welding Alloys Corp. at the May 26 meeting of the Mohawk Valley chapter. Mr. Shackleford, using slides, showed how a few cents worth of welding rod, plus proper application, can sometimes save many dollars and costly down time in repairing tools and dies. He was heard by nearly 40 members and guests who attended the dinner meeting at Grimaldi's Restaurant.

—E. Merkelbach

West Coast News

By Andrew E. Rylander

What with plant visits and meetings, have been rather crowding the schedule during the past month—June, that is. As a highlight of the summer meetings, there was the annual dinner in honor of the ladies by Golden Gate chapter, held at Rickey's in Stonestown. A delightful get-together and a wonderful dinner that topped the one at the same place in April. Dave Gustafson and his fellow officers did themselves proud, with Dave directing the plaudits to Vern Gallichotte, master of arrangements.

With my silent partner, found myself table mate with George Martin and Basil Keyes, both of George M. Martin Co., and their wives, the men extending an invitation to visit their plant. I'll accept that, first chance. Also met E. E. (Al) Riddle, who lives in Walnut Creek, and Don Becklin, with whom I also found things in common. Little by little, acquaintanceships grow.

A visit to Grove Controls, in Emeryville, where Harold Wolpman told me to make myself at home, which I did. Dave Gustafson was away and Ed Raves temporarily on the sick list. While there, ran across a couple of Goss & de Leeuw machines, which reminded me of the time back in '44 when, at the Philadelphia convention, John Sundkvist, George Highberg, Hand Rockwell and Goss & de Leeuw's Harry Hauck ganged up to show me the town. That evening we were guests of Bill Jarvis at a steak dinner, the like of which I couldn't have eaten in three sittings. Then, that is; now, I could eat a steer . . . well, a bit at a time.

Grove Controls struck me as being remarkably equipped to handle precision work. The plant is as neat as a pin with new equipment predominating. One job, on a Bullard, struck me as rather novel, but as I was on my own ambling here and there, I'll have to hold it confidential pending clearance at a later visit. I'll be back.

Also, paid a visit to Horspool & Romine's, where Ernie Romine reinitiated me into production threading. The plant is suffering from acute growing pains—a consequence of progress—in which old machines and the latest vie for space. At that, the older machines were earning their keep, thanks to good tooling that left little to be desired. What particularly impressed me was the way the men were working, everybody on the ball.

Still gadding around, got to visit Hans Metz at Olin, in San Leandro, but Hans was running highly classified products so all I can say is that he's doing right well with his new plant. Also got around to General Grinding Co., of which Dean Roulund is managing partner.

June 16, went to the grand opening of the Dodge San Leandro plant, where, by a strange coincidence, the 1,000,001st California-produced Dodge rolled off the assembly line just as the host of visitors arrived at the end of the line. By an even stranger coincidence, the 1,000,000th had rolled off the line down in Los Angeles a few hours before. Remarkable timing! Anyway, it was really a gala event with all the top Dodge brass present besides VIP's including the mayors of San Leandro and Oakland. And Roy Rogers in person, and his charming wife, whom you know as Dale Evans. Sure, I shook hands with Roy; told him now that I'd met him, I'd probably loosen up and buy a radio.

Thanks to Bill Smila, I had an "in" of a sort and so got acquainted with likeable Glen Johnson, native Californian who didn't have to go to Detroit to learn about automobiles. A foreman in '32, Glen is now plant general manager of the Dodge Leandro plant and doing right well by the company. Anyway, he was delighted to get greetings from Bill and the same are relayed back. Also got to meet quiet but capable F. J. Lamborn, Dodge veep and G.M., with whom I sent back greetings to my old friend George Everson at Dodge Main.

I had already put this writing in the mail when I received a note from John Sylvester of Pratt & Whitney, Cambridge office, together with a copy of the Worcester *Telegram* which carried an account of the recent tornado. Naturally, we had been deeply concerned for our friends in the Middle West and East, many of whom must have suffered losses because of the twisters. Worcester, in particular, is the home town of my wife.

Out here, we've been lucky; except for occasional tremblers and quakes with localized damage in nowise comparing with the wide sweep of tornadoes, the worst we've had to contend with the past year have been comparative cold and heat.

News in Metalworking . . .

CASTING PROCESS INTRODUCED FOR ECONOMY IN PRODUCTION OF BROADER RANGE OF ALLOYS

A recently perfected form of casting makes available a wide range of alloys in a form equivalent, in essential respects, to long mill rods, tubes and shapes. Previously these alloys have been available only as sand, permanent-mold or centrifugal castings. The newer form, known as continuous casting, offers another tool for greater economies in production.

As recently as 1937, American Smelting and Refining Co. completed what is believed to be the world's first commercial installation at Perth Amboy for continuously casting copper billets. Over 400 million pounds of the material have subsequently been produced.

Later, with the knowledge gained from this experience, the company constructed and brought into operation—in 1947, an improved plant for the continuous casting of copper alloy rods, tubes and shapes. The commercial production of alloy products started had in 1944 on a semi-pilot plant basis. Output of this operation has been more than 50 million pounds to date.

Today this process, called Asarco, is conisdered the only continuous casting method in commercial use producing copper-base alloy stock ready for machining or other fabricating operations. The resultant product may be used it is said as successful alternates for either cast bronze bar stock (hitherto available only in short lengths such as 13 in.); or for individual sand, permanent-mold or centrifugal castings.

According to the developers this method offers a number of important advantages:

- May be purchased in desired lengths.
- Has no harmful impurities, no blowholes, no porosity, no hard or soft spots.
- Offers improved properties with fatigue characteristics up to 33 to 100 percent; impact strength 15 to 100 percent; tensile and yield strength better than for the same alloys cast by other methods.
- Is easy on cutting tools.
- Is excellent for automatic machining.

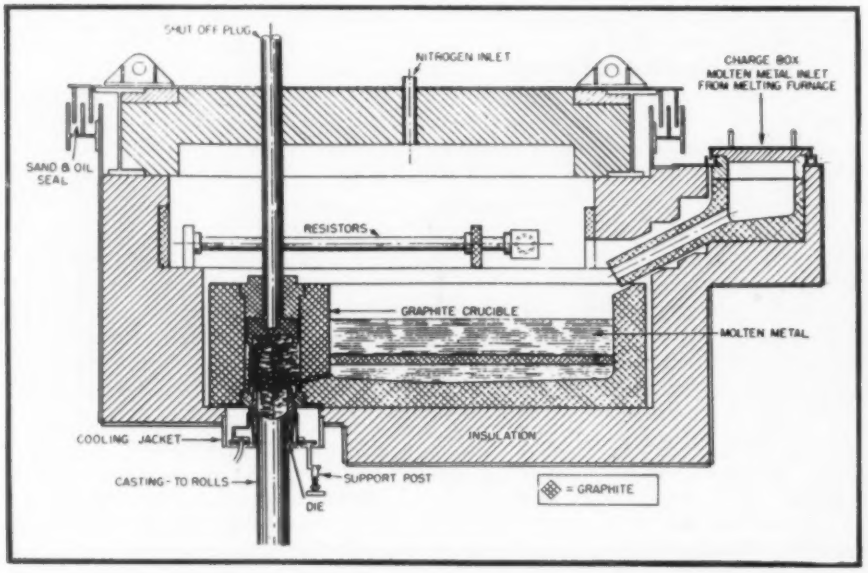
At the same time, this patented process makes it possible to procedure a wide variety of shapes and sizes from $\frac{7}{16}$ to 5 18-inch diameter and in lengths up to 20 feet.

Chemical composition of typical Asarcon alloys of two types and their consequent physical properties are listed in TABLE 1.

Table 1—Typical Asarcon Alloys and Their Properties

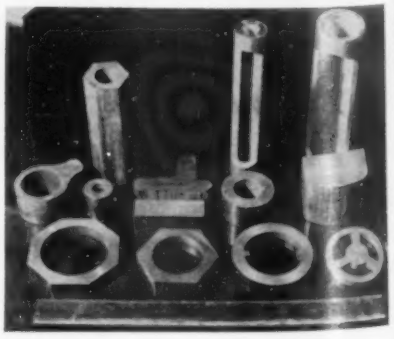
Asarcon No.	SAE No.	Nominal Chemical Composition Cu	Sn	Pb	Zn	Typical Physical Properties Tensile psi	Yield psi	Elong. % in 2 in.	Brinell Hard.
Type 1									
61	622	88	6	1.5	4.5	45,500	23,000	35	76
55	40	85	5	5	5	45,000	21,400	28	72
59	66	85	5	9	1	38,000	21,000	20	66
520	—	75	5	20	—	28,700	22,800	8	57
Type 2									
110	65	89	11	—	—	51,000	29,000	18	100
102	63	88	10	2	—	49,000	25,000	18	86
100	62	88	10	—	2	51,000	28,000	18	92
80	620	88	8	—	4	49,000	23,000	18	77
77	660	83	7	7	3	44,000	27,000	16	72
773	Composition and properties same as 77.								
1010	64	80	10	10	—	41,000	26,000	10	80
210	—	80	2.5	10	7.5	34,000	18,000	22	62

Variation in physical properties of a series of alloys cast by three different methods were studied. The alloys were a varying Cu-Sn-Pb-Zn composition, cast by the continuous process, permanent mold, and sand cast methods. Some of the alloys cast by the continuous method proved to be somewhat lower in tensile strength than the same composition cast by permanent mold. However, each sample of continuously cast alloy showed a consistent and decidedly higher yield strength and Brinnell hardness, and, at the same time, showed a lower percentage of elongation, and a lower percentage of area reduction. In *Table* 2 one may study



At left, a schematic drawing provides a cross-sectional view of the holding furnace, or crucible and die arrangement used in the Asarco continuous casting process.

Below are a few examples of the variety of shapes which may be cast by the continuous method.



Tools of Today

the comparative impact strength of these same alloys cast by two of the methods.

Table 2 — Impact Tests for Comparison Between Casts (ASTM E23-41T Type Z)

Alloy	Ft./Lb Continuous Cast	Ft/Lb* Sand Cast
88-10-0-2	25.5	8.7
85-5-5-5	20.7	12.0
83-7-7-3	12:5	9.3
75-5-20-0	6.2	5.5

*Machines from ½ in. diam bars — average of three determinations.

Data on the finish and surface straightness resulting from the continuous cast process indicate ¼ inch maximum arc depth in 5 feet length. All stock is Medart straightened, which smooths, burnishes and straightens to standards employed for wrought rod and tube stock. Inside surfaces are found consistently excellent. Study further showed that clean up allowances in general should be $\frac{1}{16}$ inch on the OD and $\frac{1}{32}$ inch on the ID. However, for many alloys and sizes, $\frac{1}{32}$ inch on the OD is found ample.

In practice, the method involves the following steps: Molten metal, supplied by an auxiliary melting furnace, is maintained at a proper temperature in the casting crucible. Solidification of the rod or tube takes place is a self-lubricating, water-cooled graphite die. Driving wheels, mounted directly beneath, withdraw the solidified product continuously at a controlled speed. A traveling saw, mounted below the driving rolls, is engaged at proper intervals to cut uniform lengths.

Equipment required includes a casting crucible which is totally enclosed within the furnace where it is maintained under a nitrogen atmosphere. The process, which operates as a true gravity-fed bottom-flow casting method precludes the possibility of trapping incidental dirt and dross. Such foreign matter as may enter the system floats on top of the melt without turbulence to carry it into the product. Freezing from the bottom upwards permits the escape of any dissolved gases liberated during solidification. The molten bath, functioning as a huge riser and head, prevents the formation of shrinkage cavities.

BASIC MATERIALS SHOW

The first Exposition of Basic Materials for Industry was recently held in New York City, and aside from showing manufacturers what materials are available, it was also a signpost for tool engineers. This show presented the materials, and thereby indicated production methods of the future.

Since a material becomes new many times as its properties are discovered, it is applied in new ways in new fields. Many of the materials displayed at this show were developed for use in a single industry. Some of these have already been applied in different industries and this show will increase the information transfer from industry to industry.

Concurrent with the exposition was a three-day conference on the technical aspects of basic materials. A sidelight on the papers is the fact that many of them treated nuclear topics; uses of radioactive materials as tracers in processes; as material level gages and as basic research tools to determine the behavior of metals during fabrication and use.

Of particular interest was a new machinery vibration absorber pad with an adhesive backing so that it does not need to be bolted. Production can start as soon as the machine is placed, and at higher speeds. Because zirconium reacts rapidly with air at high temperature, a technique of sheathing ingots in mild steel tubing with welded end plugs allows the ingot to be heated to 700 C and forged or rolled. The sheah is removed and the ingot is cold worked to size.

Also exhibited was a base metal clad with silver brazing alloy that anchors the brazing alloy throughout the heat cycle so it does not ball up during initial heating and does not produce uneven spread.

BATTELLE INSTITUTE OGANIZES RESEARCHERS SERVICE

A technological information service, aimed at assisting science and industry in streamlining the costly and burdensome job of tapping existing published knowledge, has recently been established at Battelle Institute.

"What has gone before" must be the prime question a research man answers when he begins a study. But, as Battelle Director Clyde Williams points out, an estimated 60 million pages of technical matter is published each year. So the task of finding this first answer is mountainous. "Our aim," stated Director Williams, "is to couple appropriate use of improved manual and machine documentation techniques with our long experience in the gathering and organization of research data."

Tools of Today . . .

All-Purpose Machine Represents Development In Gear Shaving

An all purpose shaving machine of the rotary crossed axes type, which combines all the principles proved effective in past gear shaving practices, has been developed by National Broach & Machine Co., 5600 St. Jean, Detroit. Prime feature of the redesigned machine is that now gear tooth crowning may be done with any standard rotary cutter, while formerly it required a specially formed cutter.

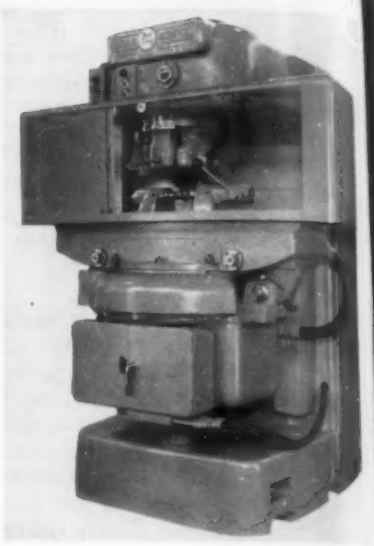
Known as Red Ring Model GCU, the gear shaver may be used either for conventional or high production diagonal shaving. For the former, the work is reciprocated across the cutter face in line with the work gear axis and fed vertically into the cutter at the beginning of each stroke. For diagonal shaving, the work gear is reciprocated diagonally rather than in line with the axis. In this case, the center distance between cutter and work gear may be fixed and the cutting cycle limited to a forward and return stroke, or the number of strokes may be increased as desired, by predetermined increments of up-feed.

This up-feed mechanism, which is incorporated in the machine, provides automatic precision operation in selected increments through the shaving cycle and automatic return to the proper backlash position for loading and unloading at the end of the cycle. Any number of automatically controlled cutting or idling strokes may be used in either constant or varied increments. As applied to diagonal shaving, it may be noted that increasing the number of strokes in the cycle increases production rate due to speed of up-feed and faster cycling. The manufacturer points out yet another feature of the multi-stroke cycle. When gear tooth stock is removed in a greater number of small increments, closer tolerances may be held and cutter life is increased—up to a claimed 200 percent.

Cam Controls Up-Feed Accuracy

The amount and accuracy of up-feed is governed by a double-sided master cam and actuated mechanically. Each knee movement is fast, positive and precise. In a typical application, the company states that a reduction was made from a former seven seconds to one second through use of this differential feeding.

The cam involved is manufactured to accommodate a combination of various feeding cycles. Only part of the cam surface is used in service if the number of cutting strokes is to be reduced. Repositioning or changing the cam is a simple and quickly accomplished operation.



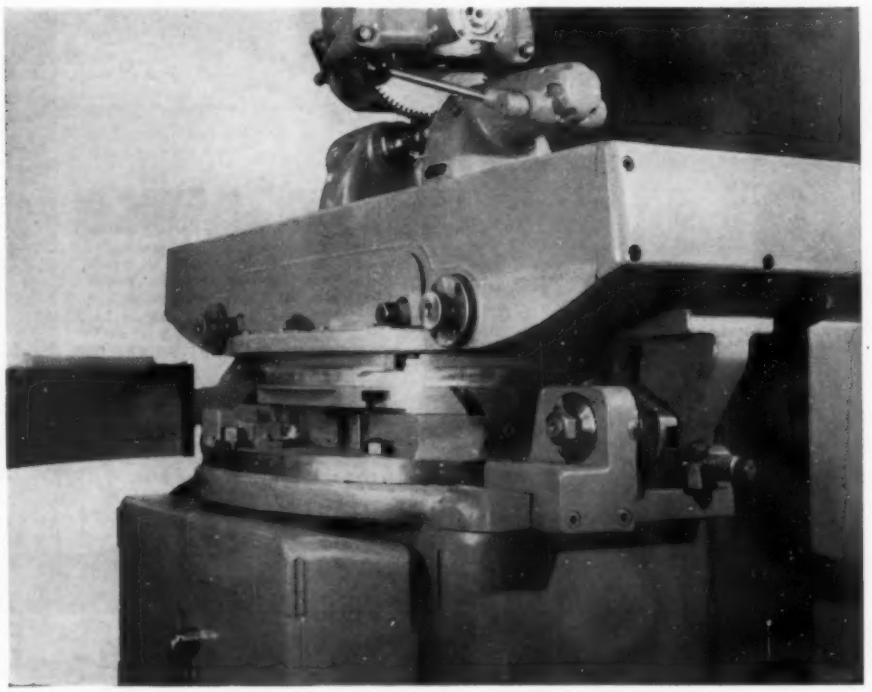
When used for conventional shaving, the machine table may be held in a horizontal plane for shaving straight gear teeth, either spur or helical. It may be locked at an angle to the horizontal for shaving taper teeth, or it may be rocked as it is reciprocated in order to produce teeth of the elliptoid form. A central pivot and cam which raises each end of the table alternately as the end of its cutting stroke is approached accounts for the rocking action. By this motion, the cutter is forced to bite more deeply into the ends of the work gear teeth to leave a slight regular crown between.

When it is desired to shave gear teeth, spur or helical without a crown, the crowning cam is disengaged. The table then remains horizontal throughout its stroke.

Gear Position Governs Crown

The work gear is positioned with reference to the cutter to govern the point of maximum crown. Amount of crown is a function of the table actuating cams.

In this way, crowning can be accomplished by rocking the table or by grinding the crown in the shaving cutter.

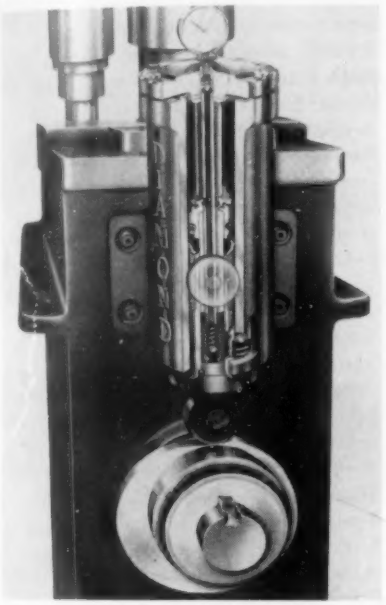


USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Clutch Equipibrator

The Diamond Machine Tool Co., 5111 Coffman-Pico Road, Pico, Calif., announces a new clutch equipibrator (patent pending) that is now standard equipment on their line of Diamond Multi-Max punch presses and shears.

The equipibrator is a two-part unit consisting of a heart-shaped cam and an air chamber with an automatic pumping and regulating mechanism. This development, as used on punch presses, counterbalances the variable



punch and die plates which vary from one setup to another; acts as a frictionless brake; and removes all the load from the clutch assembly at the time of disengagement.

The heart-designed cam is installed on the crankshaft and secured to the face of the brake drum. A roller rides on the surface of this cam, thereby counterbalancing the ram weight. At upstroke of ram, the roller pressure on the surface of the cam rotates the crankshaft approximately five degrees ahead of the bull gear wheel. At point of clutch disengagement, this prerotation eliminates all drag and pressure on the length of the clutch dog. **T-8-1011**

Collet Stop

Wade Tool Co., Waltham, Mass., has brought out a collet stop that makes it easier for the lathe operator to perform certain second operation work. For instance, it is frequently required that second operation work be located in the collet at the same setting every time to obtain duplicate shoulder lengths.

The Wade collet stop serves this purpose for three reasons: The stop is held immovable in the lathe spindle regardless of whether the collet has an indeterminate endwise location or not, so that shoulder lengths are always held exactly the same. In setting the position of the stop it is not necessary to remove the stop from the collet and the collet from the lathe for any required adjustment; the adjustments are made entirely from the rear end of the spindle with a screwdriver. Because the stop is held in position by means outside of the collet itself, in the drawbar, practically the full length of the collet (4 inches) may be utilized for the workpiece. Thus, the workpiece is not limited to a length of 1 or 2 inches within the collet, as in the case of a stop which is also held within the collet. Furthermore, because the stop is held externally, there is no possibility of distorting the collet from internal pressure as can occur in holding the stop within the collet.

No alterations to the collet are necessary. The stop is attached to the draw-in spindle and can be adjusted and used immediately.

Two solid pads are furnished, suitable for different diameters of work; and one spring pad where it is desired to eject work as soon as the collet is released. Special shapes and sizes of pads can be substituted for the standard pads. **T-8-1012**

Foot Switch

A snap-action foot switch for starting and stopping electrically operated equipment has been introduced by Electromatic Devices Corp., 3345 Addison St., Chicago 18. The switch is said to eliminate waste motion when used for starting and stopping motors, lathes, presses, saws, drills, grinders, portable tools, riveting and welding machines; operating relays, solenoids and magnetic switches; controlling light on enlarging cameras and other photographic devices; operating medical and dental equipment; switching sound and transmission apparatus. Foot control keeps both hands free for greater safety and faster production. It takes but a few seconds to install by simply inserting the series plug on the foot switch cord into the wall receptacle, and plugging apparatus to be operated into the series plug. No re-wiring or soldering is necessary. Specifications are: switch unit is a patented snap-action switch specially designed to handle high inductive loads with a minimum of arcing, thus giving them a high ampere rating; current rating, 15 amperes at 115 volts, housed in a durable metal case. An anti-skid pad on the bottom grips the floor to hold the switch in operating position. A rubber tread on top prevents the operator's foot from slipping. Overall size: 4½ inches long, 3 inches wide, 1 inch high, black finish.

T-8-1021

Air Clamps

Mead Specialties Co., Chicago, has added three new air clamps, spring return air cylinders and two new air valves, to its line.

The air cylinders are: model H-71, power factor—7 times line pressure, stroke—1 inch and bore 3 inches; model H-72, power factor—7 times line pressure, stroke—2 inches and bore 3 inches; model H-73, power factor—7 times line pressure, stroke—3 inches and bore 3 inches.

Model PC-101 is the same valve as model FT-101 but in place of the lever has only a button mounted directly on valve plunger to be actuated by operator's palm or fist. Openings are 5/16 inch throughout. Hose nipples fit ⅜ inch. ID hose.

Model PC-1 is another variation of model FT-1. It is ultra-compact and easy to mount and is quick-acting with air cylinders up to 3 inch bore. Hose nipples fit ¼ inch ID hose. With 1000 psi air-line pressure a force of about 10 lb is required to push the button.

Information may be secured by writing Mead Specialties Co., Dept. CV-74, 4114 N. Knox Ave., Chicago 41.

T-8-1022

Vacuum Pump

Mechanical high vacuum pumps which will pump condensible vapors, such as water vapor, without oil contamination or loss of pumping capacity, are now available. The introduction of the NRC rotary gas ballast pump is the result of joint efforts of National Research Corp. of Cambridge (Massachusetts), and E. Leybold's Nachfolger, of Cologne (Germany). National Research Corporation is importing the basic pump units and is adding American motors, pulleys, flanges, and controls.

The NRC gas ballast pump prevents the condensation of vapors by keeping the vapor pressure of the vapors below

their condensation pressures. This is done by use of gas ballast. A small quantity of air is bled into the pump after intake has been completed and as compression is about to occur. The power requirements are as low as or lower than those for conventional mechanical pumps lacking the gas ballast feature.

To date condensed vapors have been a problem requiring special attention and accessory equipment. NRC rotary gas ballast pumps prevent the occurrence of that problem. This eliminates the need for oil treating units and greatly reduces oil consumption and oil inventory.

The pumps are offered in single-stage units with capacities ranging from 2 to 400 cubic feet per minute, compound units (i.e. two rotors on the same shaft) with capacities from 2 to 15 cubic feet per minute, and in combination units (in which two single-stage pumps are combined in series) with capacities from 30 to 400 cubic feet per minute. National Research will stock the pumps and spare parts at their Newton, Mass. factory. Technical service on both pumps and their process uses are available from NRC.

T-8-1031

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Nibbler

A power nibbler that has a detachable crankcase is offered by Nord International Corp., Denville, N.J. This nibbler also beads, folds, cuts straight or circular and cuts slots, louvers as well as irregular or freehand by very simple adjustments.

The nibbler mechanism operates in an enclosed oil bath. The detachable crankcase is so designed as to permit the construction of special frames for special purposes at reasonable cost. Reassembly of the detachable crankcase to any special type of frame is a simple matter with standard tools.

This nibbler is designated as the Nord model G nibbler and has been designed and constructed to make the changing of tools exceptionally easy.

The patented lower tool holder is the reason in that it has the same center line as the upper holder and a handwheel quickly makes a fine adjustment to any desired setting. No rough adjustment is necessary.

Another feature is that of being able to change from circular cutting to straight cutting without removing the lower slide block. Only the upper slide need be released and removed by sliding to the rear.

The range of materials that can be cut are 3/32 inch continuous cutting of cold rolled steel (1/8 inch short cuts), 5/64 inch stainless and 5/32 inch brass or copper. The largest circle that it will cut is 28 1/2 inch diameter and the smallest 2 23/64 inch diameter. It folds to 5/64 inch and beading to 3/32 inch plate thicknesses are readily accomplished.

Over-all dimensions are 50 inches long x 31 1/2 inches high x 13 inches width with a throat depth of 28 17/32 inches. A 0.65-hp electric motor provides power and is mounted directly behind the crankcase enclosed drive. For details write to Nord International Corp., P.O. Box 44-N137, Denville, N. J. T-8-1041

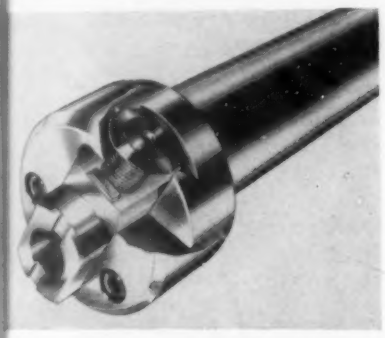
USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Boring Chuck

Recently announced was the Samson heavy duty offset boring chuck. This chuck is reported to have a patented, positive dead-centering feature for drilling and milling, which eliminates the necessity of chuck removal. It is claimed that this feature facilitates quick, time-saving tool changes and makes possible extreme accuracy in boring, drilling, milling and similar tool operations.

Another feature of the Samson chuck is its extra-large dial with micrometer screw. This makes possible the precision adjustment of offset and an extremely accurate resetting for duplicating an operation.

All-steel, hardened and ground, with all moving parts lapped, the boring chuck has a one-piece body and shank. It is claimed that these and other design, engineering and construction features, enable the chuck to support the tooling as rigidly as the machine itself, in heavy-duty operations.

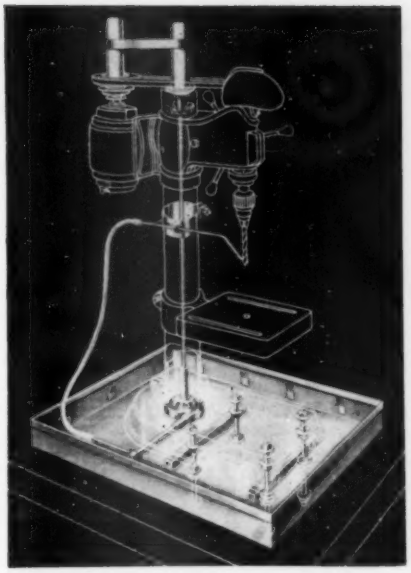


The manufacturers state that their boring chuck is available with any shank or adaptor for holding boring bars, drills, end mills and similar tools. Also available is a complete set of interchangeable accessories made of alloy steel. These are heat treated and ground to a 0.005-inch slip fit in the tool block of this heavy-duty chuck. In addition, the offset accessories are designed with a key drive.

Write the Last Word Sales Co., 18500 Mt. Elliot, Detroit 34, for further information. **T-8-1051**

Coolant Pump

Compactness and convenience are provided in the coolant supply unit offered by Wade and Sons, 986 E. Truman Road, Independence, Missouri. It can be installed into the hollow column of any popular make bench drill press. No separate motor is required. Driven by the drill press motor, which is higher than the coolant supply, it eliminates the danger of electrical shock. Operating with a half-gallon of coolant of any type, the pump carries the liquid through tubing beneath the drill press. Made of extra heavy gage steel, the pan



is provided with clips on the sides to hold splash shields when additional height is desired. The pump intake is screened to keep out scrap that might clog the flow line. The small pan simplifies changing of coolant for different work requirements.

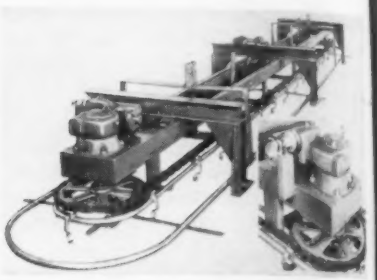
All fittings to adapt the device to all well-known makes of bench drill presses are supplied in the complete kit, with simple instructions for quick assembly.

Advantages claimed include longer drill life, better size control and finish, faster speeds and feeds, in addition to eliminating encumbering coolant drums, extra motors and rigging. **T-8-1052**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Plating Machine

Wagner Brothers, Inc. has designed a packaged semiautomatic plating system to replace or augment still tank plating for the electroplating field. With standard types and several variances now installed and in production, users consistently record increases of 100 percent more production and higher quality at the same labor cost as for previous still tank methods, it is claimed.



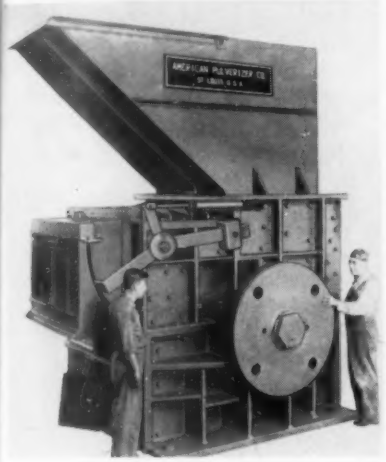
The first advantage of the Wagner semiautomatic is its versatility. When a run is completed (or between runs of a certain part), the system may be altered for a different job by simply shifting the pusher shoes to the desired spacing. Spacing to any dimension in 2-inch increments may be accomplished in a minimum of time by removing the pusher shoes. The second advantage of the Wagner semiautomatic is in the reduction of maintenance costs; all wear points are Zerk lubricated, the standard roller chain is available everywhere, and the Micarta pusher shoes last indefinitely. The variable speed control and drive are combined in one unit which may be replaced in minutes by removing a few hold-down bolts. Standard V-belts are used for drive and agitating mechanisms. The plating shop hazards of drip, moisture and corrosion are eliminated by the totally enclosed ball-bearing motor. For long life, the driving sprocket shaft turns on three bearings, two in the speed reducer, one outboard in the frame. Efficient agitation is obtained by longitudinal motion; the mechanism is mounted at one end on a single bracket with V-belt drive. A feature of the Wagner semiautomatic is the clean design which permits loading at any point, even at the ends of the tank. The anode bar is formed equidistant from the cathode at ends as well as sides so that plating is uninterrupted and quality is uniform. The packaged semiautomatic includes tank to standard or user's specifications, is completely insulated at critical points and wired ready for installation. Write to Wagner Bros., Inc., 463 Midland, Detroit 3, for further information.

T-8-1061

Scrap Crusher

The American 60-50 metal turnings crusher, according to the manufacturer, is the largest metal turnings crusher ever built. Designed to reduce metal turnings, aluminum castings, such as crankcases, pistons, pots and pans, etc., and many other forms of scrap at a rate of 35 to 50 tons per hour, this crusher is recommended for large-scale operations in industrial plants, aluminum smelters, and metal recovery yards. The reduction of long metal turnings can become a source of additional profit because metal chips command a higher price in the metal market. In addition, there are substantial savings in storage and freight.

This crusher uses the original out-



standing American rolling ring principle which has been proved and tested for forty years. Tremendous kinetic and centrifugal forces are exerted on the turnings or castings by the massive manganese steel shredder rings. The flexibility of the American rolling ring principle also permits these rings to deflect and pass over heavy tramp metal that might seriously damage other types of crushers. Because these rings roll, wear is distributed over all the cutting edges. The rings are also reversible for longer life. The construction of the rotor insures that wear is distributed evenly across the width of the machine.

Wherever a large volume of metal turnings, aluminum or similar scrap is present, this crusher will efficiently reduce the material to a desired size. Capacity depends upon the material involved and has averaged as high as 50 tons per hour. Further, this crusher will reduce many kinds of scrap which previously no crusher could reduce.

For further information, write to American Pulverizer Co., 1533 Macklind Ave., St. Louis, Mo. **T-8-1071**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Conduit Fitting

A fitting for liquid-tight flexible conduit mates with any conduit spiral and doesn't have to be taken apart when installed according to its manufacturer. The Thomas & Betts Co., Elizabeth, N.J. The fitting is said to be ideal for machine tool wiring or other similar electrical circuits exposed to corrosive liquids and mineral oils. It is made in straight, 90-degree and 45-degree elbow designs and accommodates conduit from 3/8 to two inches trade size. The design was developed with the cooperation of the Metal Hose Division. American Brass Co., which made the first liquid-tight, flexible conduit approved by Underwriters' Laboratories.

Another advantage claimed for the fitting is the fact that only one wrench size is needed for the gland and the body. A color coded plastic seal in the gland indicates a fitting's size and the fact that it is a liquid-tight type. When the colored seal is visible after installation of the fitting, the raceway is properly grounded. The end of the fitting facing the junction box has sufficient length to accommodate double locknuts used with sheet metal boxes, says the company. It also points out that tapered pipe threads provide a liquid-tight connection with cast iron boxes. The fitting's body is die cast from a high-strength zinc alloy for the three smallest straight sizes. Other sizes are of malleable iron.

Since the metal spiral of liquid-tight flexible conduit is enclosed in a tight-fitting plastic tube, the fitting ground connection cannot be made outside. Instead, this is done inside the conduit where the metal spiral's surface is exposed. Furthermore, manufacturing variations inherent in the production of flexible conduit require that the fitting's grounding device take such variations into account. Consequently, they developed a conical-shaped ground, which wedges inside the conduit in a tight fit. The gland simply is tightened around the conduit and the joint is completed. Because the ground's wedge-type action doesn't depend on the particular conduit spiral, the fitting mates with any conduit spiral and does not have to be taken apart for installation.

T-8-1081

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Foot Switch

Monochromatic Light

Claimed to be the largest monochromatic light generator on the market, The DoALL Co.'s Monolight features a 20 inch diameter, high intensity light source. The instrument was developed to meet industrial demands for greater capacity so that large parts or large numbers of smaller parts can be checked more easily and rapidly for surface flatness, finish, dimension, etc. Also, this Monolight is intended to facilitate the use of large optical flats, up to 10 inches in diameter.

Twenty-four inch work height capacity of this light generator permits parts of considerable thickness to be inspected. Sizable quantities of parts may be checked more easily on the large work table, 30 x 30 inches, which is completely blanketed by monochromatic light of 20-foot-candle intensity as measured on the working surface. Another advantage

of the large work area is that groups of parts to be checked with optical flats can be allowed to normalize right at the light source. For convenience and to accommodate large work, the head of the instrument can be swung in a 160-degree arc from side to side.

The light generating element in the Monolight is mercury vapor. Monochromatic light from mercury vapor provides better fringe line definition and less glare than do other commonly used light sources. Excellent diffusion of light is made possible with a newly developed ceramic diffuser which eliminates the pattern normally created by the light generating tube. The new light generator is lightweight for its size, due to the use of aluminum in all construction, except for the work table which is of cast iron to provide stability.

For additional information, write The DoALL Co., Des Plaines, Ill. **T-8-1091**

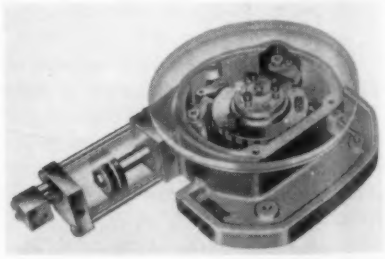
Foot Switch

General Control Co., Boston 34, Mass., is now in production on their type MA foot switch with several new features of general interest. Internal switching action has been improved by using the new, long-life, general control SPDT du.op limit switch. Access to the internal du.op switch terminals is greatly facilitated by simply removing the front end of the new two-piece top casting.

The actuating treadle is built into the top of the MA foot switch; it requires unusually light foot pressure, and permits fast operation with minimum fatigue. The cable enters the switch through the front by means of a BX connector or a rubber grommet, as specified. Mounting is by means of holes in the housing. **T-8-1101**

Dial Feed Table

The A. K. Allen Co., 57 Meserole Ave., Brooklyn 22, N. Y. announces the manufacture of its model 11FA and 11FB dial feed tables with positive lock feature. The major engineering advance of this table is that the top plate cannot override and lose index under the most severe conditions of operation. This is achieved by the use of an auxiliary air cylinder built inside the table whose function is merely to bring into a toggling position, a set of mechanical members which lock the feed pawl to the ratchet in the most positive fashion yet devised on this type of indexing table. In the indexed position an anti-backup pawl locks the table against rearward rotary motion.



A hydraulic check is offered as an accessory and provides a controllable shock absorbing effect at the end of every index stroke for operations requiring extra smooth operation.

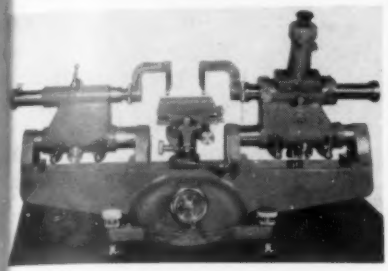
Both models are available in the standard 4-6-8-12 and 24 set of indexing positions. Accuracy of indexing is guaranteed to ±.002 inch measured at the periphery of the 11-inch top plate.

Model 11FB is identical to model 11FA except for the addition of a two-way valve and a pilot timer valve to make the table operate fully automatically as a self-unit. **T-8-1102**

Measuring Instrument

Through the use of a built-in 4-inch glass scale, the Microptic measuring machine, horizontal type, provides a means of measuring lengths or diameters of gages and parts to 0.00005 inch direct reading and 0.00001 inch by convenient estimation.

With simple standards of 4-inch length, it can be extended to a maximum capacity of 14-inch external measurement and 10-inch internal measurement. The work table is fully



adjustable, including provisions for tilt and rotation. It is therefore possible to align the workpiece quickly to check true maximum or minimum dimensions.

Since no gage blocks or other length standards are required with each measurement, the machine is a self-contained unit for rapidly checking gages or pieces of varying size. The built-in scale operates without wear, assuring a permanent and flexible measuring device, that gives absolute and reliable readings.

The Microptic measuring machine is available from Engis Equipment Co., 431 S. Dearborn St., Chicago 5.

T-8-1111

Solvent Degreaser

Brulin solvent degreaser combines several features which make it an excellent solvent for production line use. Practically nontoxic and noninflammable, it is safe to use without requiring special safety clothing or special ventilating equipment. Health hazards are eliminated while the efficiency of prime solvents is retained.

This solvent degreaser does not contain carbons tetrachloride or other toxic chlorinated solvents. It is a highly concentrated solvent for all degreasing and cleaning operations. It is economical to use, low in cost, and is available in drums from 5 to 55 gallons. For additional information, write to Brulin & Co., Inc., Dept. 301, 2939 Columbia Ave., Indianapolis 7, Ind.

T-8-1112

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

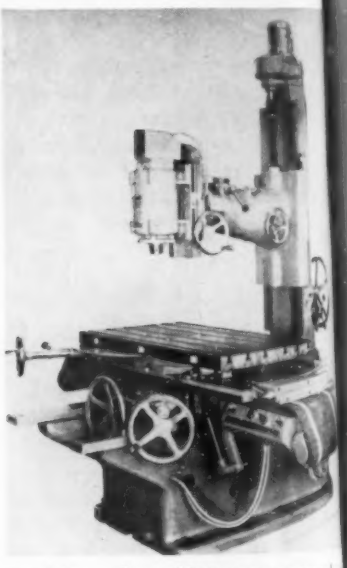
Milling Machine

A pattermaker's milling m
Bokoe Model 2, with an unusual
worktable and deep throat
chining many sizes and sha
ferrous, nonferrous and wood
pieces, is being distributed b
Orban Co., Inc.

Manual controls on the wo
provide for 28-inch transverse a
inch longitudinal movement.
automatic feed, longitudinal mo
is infinitely variable from 3
inches. Transverse and rotary
ment are also provided by aut
feed. The size of the table an
length of the table travel freq
permit the handling of many job
one setup instead of two.

Maximum diameter of turntable
is 102 inches. Depth of throat be
column slide and spindle center
inches. Machine is sturdily des
to make effective use of this
throat without sacrifice of acc
The power-driven turntable
greater working height than the
table turntable customarily use
conventional millers.

A wide range of settings and a
ments, as well as spindle speeds
provided. The variable speed cha
can be operated without stopping



machine. In addition to normal
eration as a milling machine,
Bokoe Milling Machine can also
used as a radial drill. By turning
swivel column 180 degrees, cast
mounted on skids on the floor can
drilled.

All operating controls and levers
easily accessible. Column and vert
slide are fitted on the base which
holds the longitudinal slide, cross
and worktable. Worktable can
swiveled for performing circular wo

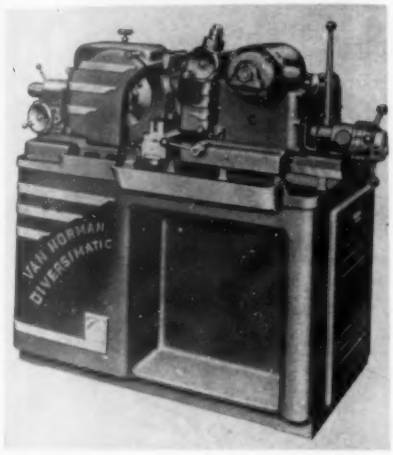
Additional information and specifi
tions can be obtained from Kurt Orb
Co., Inc., 205 E. 42nd St., N. Y. 17.

T-8-12

Centerless Grinder

The Van Norman Co., Springfield, Mass., announces the Diversimatic centerless grinder. The Diversimatic is a machine for grinding a great variety of parts such as bearings, bushings, cap screws, shafts, formed parts of two or more diameters or contours. It is especially suited for grinding parts used in office machines, instruments, small aircraft parts, munitions and other similar work. It is a rugged precision-built grinder having many features which insure high micro finishes and close tolerances at fast production speeds.

Some of the features of the machine include: special, easily removable grinding wheel, spindle quill, with



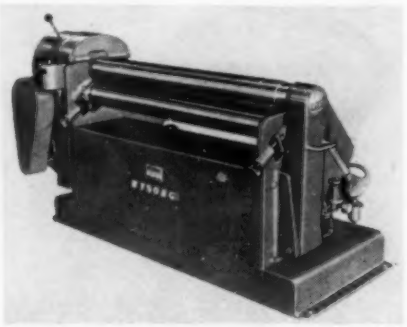
combined double-row super precision ball and roller bearings, sealed and lubricated for trouble-free operation; spindle requires no warm-up period; combination straight and contour grinding wheel dresser; straight screw-type regulating wheel dresser; grinding wheel diamond constantly flushed from below with coolant during wheel dressing; infinitely variable ¼ hp regulating wheel drive, 30 to 300 rpm; large 1⅞-inch 4 thread; Acme infeed screw with full-length split type nut to compensate for wear; work-rest adjustable for position; may be fixed across the ways or made to feed in and out with the regulating wheel.

Of special importance is the crush forming attachment. This attachment provides a means of grinding small formed parts to high precision that can't ordinarily be ground between centers due to work deflection. It dresses the wheel face to the desired contour imparting the exact profile to the work. **T-8-1131**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Steel Rolls

All steel, 5-inch rolls of the initial or pinch type, in five sizes, have been introduced by Wysong and Miles Co., Greensboro, N. C. Frames are one-piece, all steel weldments. Rolls are accurately machined and polished alloy forgings. Each roll is power driven and is grooved to buyer's specifications. Machine-cut steel gears run in a continuous bath of oil and automatically remain in proper mesh at any roll



setting. Roll setting indicator scales are mounted on both end frames.

The right-end bearing housing for the top roll drops to free the top roll for lifting and removal of formed cylinders. The motor drives a flywheel through V-belts. Three-way drum control provides forward, reverse or neutral settings.

Optional features are available as extra equipment and include power operation of drop-end, magnetic brake for main motor, magnetic starters and push-button control, and power adjustment of rear roll. **T-8-1141**

Grinding Fixture

A radius grinding fixture has been developed by the Apex Tool & Cutter Co., Inc., Shelton, Conn., for redressing radius tools of the serrated inserted type used for finishing axles with 1/8 to 3/4-inch radii.

This fixture is designed to regrind the 3/4-inch radius on both the right-hand and left-hand tools to give a true radius for cutting journal bearing surfaces. Accurate contour on an axle-turning operation facilitates the burnishing job which follows. The fixture features built-in adjustments to allow for tool wear both on length and width. It is built with opposed roller bearings for rigidity and designed to fit any table of a standard tool and cutter grinder, as well as most grinders with mechanical in-feed hand wheel.

Although designed primarily for the 3/4-inch radius grinding, it also can be used to grind or dress other radii within a range of approximately 3/8 to 1 1/8 inches. **T-8-1142**

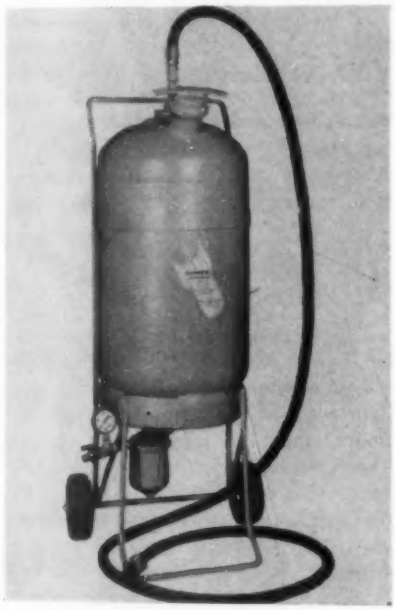
Radial Gage

A pivotal arm type radial internal clearance measuring instrument is announced by The Sheffield

Sand Blaster

The Block Buster, a sand blasting application incorporated in an easy-to-operate portable machine is now on the market. The machine uses any clean dry sand that will pass through a 16-gage screen, metal shots, flint shots, grit or finer sand-blast sand such as No. 00, No. 0, and No. 1 and is engineered for economical operation and long life with no moving parts or mixing chambers to wear out. It operates from any direct air line or compressor having 80 lb or more pressure and the average air consumption is 30 to 35 cfm, depending on nozzle size and air pressure used. Pressure is adjustable to from 30 to 120 pounds for each specific job. Thus, cleaning operations require only a fraction of the time and labor necessary with other methods.

The Block Buster readily removes concrete, rust, scale, paint, and dirt and



can be used on metals, stone, brick, wood, plastic or glass surfaces. The Block Buster is available in 3 models with sand capacities of 90, 150, and 200 pounds. Literature may be had by writing The Corson Company, Investment Bldg., Washington 5, D. C. **T-8-1151**

Power Bender

Redesign of their hydraulically operated bending machines to more evenly distribute the stress and strain developed during bending and also keep mechanical distortion to a minimum is announced by O'Neil-Irwin Mfg. Co., 625 Eighth Ave., Lake City, Minn.

According to the company, changing the design of the bending table from fabricated steel to a strongly-ribbed alloy casting provides greater strength during bending and also allows the

integration of the gear housing into the casting assuring positive alignment at all times.

Further improvements are the addition of foot controls as well as hand controls, which free the operator's hands for material handling and work positioning; replacement of a 2-hp motor with a 3-hp motor; use of one-quarter to one-half inch steel plate instead of sheet fabrication on the cabinet which results in improved rigidity.

The Di-Acro power bender is an all-purpose machine which can be used for forming simple and complex bends in round stock, tubing, angle, channel, molding, strip stock, extrusions and many other ductile materials. It is possible to bend in either a clockwise or counterclockwise direction. **T-8-1152**

Press Brake

Radial Gage

A pivotal arm type radial internal clearance measuring instrument is announced by The Sheffield Corp., Dayton 1, Ohio. It makes possible easier, faster, and more accurate measuring of radial play in ball bearings. The instrument may be used to accurately measure radial play on a production basis as well as inspect incoming shipments or set up control over radial play before bearings are assembled with their components. It is easy to use and an inexperienced worker can learn the simple four-step operation in a short time.

The instrument features two adjustable, air-operated pivotal load bearing arms that alternately exert upward and downward pressure on the bearing. At the same time it measures the successive movements of the outer ring to determine the amount of radial play of the bearing in that position.

Other features include an automatic shakedown of the balls into the bottom of the groove; direct readings without use of costly masters; a single three-station foot pedal control of load bearing arms; easily changed arbors that correspond to the internal diameter of a bearing's inner ring. **T-8-1161**

Vibration Isolator

The Connecticut Hard Rubber Co., Inc., New Haven, Conn., has developed a new shock and vibration isolator. Called the Cohrlastic DS non-linear mount, the unit provides shock and vibration protection for electronic equipment, delicate instruments, aircraft engines and a wide variety of equipments which may suffer damage in use and in shipment. It also finds application as a shock mounting under heavy machinery which receives an occasional severe stress.

The mounting, in addition to being of the non-linear type, has a decreasing slope of its load-deflection curve. This means that the mount absorbs small vibrations with little deflection or movement of the equipment. At low loadings, it is relatively stiff. At high loadings, such as a heavy shock, when a piece of equipment is dropped, the mount serves as a soft cushion absorbing the energy of impact and returning the equipment unharmed to its original position. Its ability to absorb the energy of a shock load is unsurpassed.

The mounting has little tendency to develop resonant frequencies. The units are available in a wide range of sizes from small ½ lb. rated loads to large 500-1000 lb. rated loads. The same basic principle of design and functionability applies to all sizes. **T-8-1162**

Limit Switch

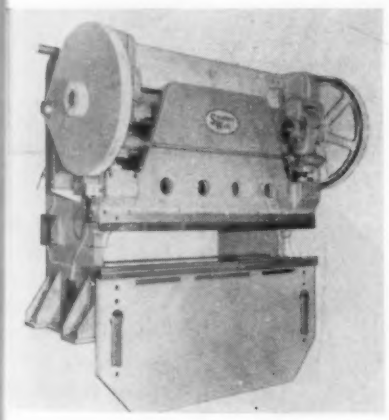
Press Brake

A 400-ton capacity press brake has been announced by Struthers Wells, and designated model 400-PB-8, it will form steel up to ¾ inch in thickness and 8 feet in width.

The model 400-PB-8 press brake, one of a series of six in the 400-ton class, affords the operator complete control at all times with instant stopping of the ram at any point. It is provided with pneumatic clutch and separate brake, operating controls for cycling and inching, plus control for a single work stroke with return of the ram to up position.

Design of the press brake is such that the force is exerted along the center-line of the side frame and directly down to the bed on its supporting leg of the frame. This straight-line power push eliminates twisting of the side frame, minimizes deflection and helps maintain alignment between ram and bed. Since the ram and bed are deep and deflections are low, the press brake gives excellent results when working to close tolerances and on coining operations.

Automatic force feed lubrication to all major points assures continuous



operation. The motor is punch press type, driving the flywheel through V-belts. A removable foot pedal and hand lever allow simplified manual operation, and safety pins lock out the controls to prevent accidental engagement of the clutch.

All welded parts are stress relieved in large heat treating furnaces to increase their ability to handle maximum loading without permanent distortion. Beds have machined surfaces which are accurately fitted and heavily bolted.

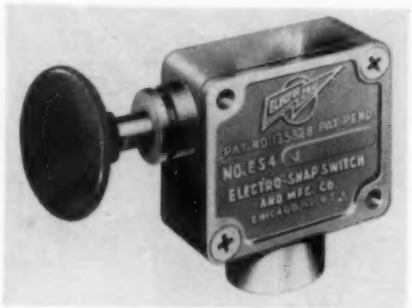
Bulletin No. P-752 describes these press brakes and also includes charts showing specifications and dimensions for all forty-four models. Bulletin P-752 may be obtained from Struthers Wells Corp., Machinery Div., Titusville, Penna.

T-8-1171

Limit Switch

An industrial limit switch designed to make possible more inexpensive circuit controls by minimizing the need for relays in automatic sequencing or interlock operations is now available from Electro-Snap Switch and Mfg. Co., Chicago. The switch, type ES4-J, has a die-cast case and integral plunger-type actuator. A 1¾-inch diameter phenolic plastic button attached to the end of the actuator makes the switch easy to operate manually for stop and start control of motors, etc. Its small size and adaptable mounting means make it possible to locate the switch at the most convenient position for the operator.

The switch is also recommended for use as a safety switch. With two switches of this type connected as interlock switches in the control circuit



of, for example, a punch press, a worker must depress both switches with his hands before the press will operate.

The switch is available with either constant or one-way momentary contact action. Constant contact action completes a circuit as the switch is actuated and "breaks" the circuit as the actuating force is removed. When actuated, the one-way momentary contact model sends an electrical impulse and then opens the circuit for the rest of the plunger's forward movement. The switch is not tripped as the plunger returns to its originally extended position. This type of action eliminates the need for costly relays in automatic sequencing operations and provides an opportunity for unusual and inexpensive control circuits.

The switch has a high electrical rating, 10 amps at 125 v ac, and long life; is available with a single-pole, double-throw circuit arrangement only. Mounting is extremely versatile and the switch is easily wired into a circuit through a standard industrial conduit connection. Clearance dimensions including knob actuator and conduit connector are 3⅜ x 2⅝ x 1¾ inches.

For information, write to Electro-Snap Switch and Mfg. Co., 4218 West Lake St., Chicago 24. **T-8-1181**

Volt-Amp Tester

Power Hack Saw

The Keller No. 4 Hy-duty power hack saw has a capacity of up to 7 x 7 inches. The quick acting swivel base vise operates to a 45-degree angle and has a capacity of 4 x 7 inches at 45 degrees.

Variable power pressure regulator provides blade pressure from 0 to 200 pounds. This greatly increases the efficiency for cutting materials from lightest wall tubing to heavy shafting.

Adjustable foot lift helps hold saw frame in position while loading or unloading saw. This enables operator to use both hands for setting and starting saw.

This model has automatic lift on reverse stroke, adjustable bronze bearings for guide bar in saw frame, built-in coolant tank and pump, and is equipped throughout with Oilite bearings.

Two speeds of 80 to 140 strokes per minute are available by shifting belts. This model requires a floor space of only 17 x 51 inches. Standard equipment includes automatic stop switch and automatic belt take-up. Further information can be obtained by writing to Sales Service Machine Tool Co., 2363 University Ave., St. Paul 14, Minn. **T-8-1191**

Angle Grinder

Ingersoll-Rand Co. introduces an air-powered, direct drive angle grinder. Its design eliminates the need of bevel gears, or gears of any kind. The size 2FA-60 angle grinder has enough power to provide fast, safe, and efficient operation on practically all surface grinding, cutoff and sanding jobs. Speed, at 90 psi air pressure, is 6000 rpm.

Two types of dead handles are available for this new grinder, one is straight and the other is 30 degrees off of straight. These handles may be attached to either side of the grinder, and the angle dead handle may be rotated to any one of four positions. This means that the tool can easily be adapted for corner grinding or for right or left-handed operators.

A built-in lubricator provides ample lubrication for long, trouble-free service. The motor is effectively muffled to reduce noise, and the exhaust deflector is adjustable to deflect the exhaust away from the operator. Heavy-duty ball bearing construction throughout reduces friction to a minimum, while a quick-acting throttle makes this grinder easy to use.

For further information, write Ingersoll-Rand Co., 11 Broadway, New York 4. **T-8-1192**

Volt-Amp Tester

The Amprobe Junior, a snap-around volt-amp tester built to do a specific job at low cost, is now being introduced by the Pyramid Instrument Corp., Lynbrook, N. Y. One inexpensive pocket tester does the complete testing job. The Amprobe Junior is a snap-around ammeter which measures current instantly without shut-downs or ammeter connections. It is a voltage meter which gives an accurate voltage reading without guesswork on a full-size 1.8-inch calibrated scale. The Amprobe Junior combines the ruggedness of a tester with the accuracy of an instrument. Accuracy for both amperage and voltage is ± 3 percent of full scale.

To measure current without ammeter connections, snap the trigger-operated jaws around one conductor (insulated or uninsulated). To measure voltage, plug the test leads into instrument and clip to load.

The customer can choose the range that fits his particular job: model 10: 0-10 amps ac, 0-125/250 volts ac; model 25: 0-25 amps ac, 0-125/250 volts ac; model 50: 0-50 amps ac, 0-125/250 volts ac; model 100: 0-100 amps ac, 0-125/250 volts ac.

Other features include a 3-inch d'Arsonval high-torque movement with Alnico 5 magnet. Probe jaws are completely insulated, and tapered for hard-to-get-at wires. Transformer joints are dovetailed. It is pocket-sized, shaped and balanced for one-hand trigger operation, and has high-visibility no-rim window. T-8-1201

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

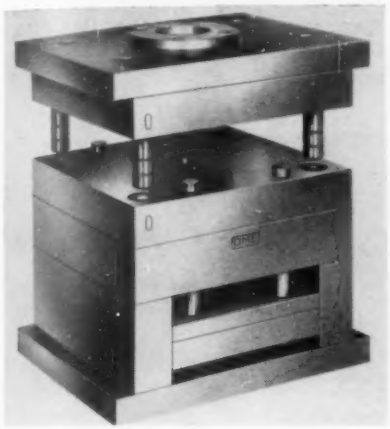
Single-Spindle Lathe

Designed for high efficiency operation in diversified production

Mold Base

The 9 x 8 inch A-R series mold base has been engineered especially for use in smaller plastic injection molding presses. It offers more usable cavity area than any standard mold base of equal size (a total of over 48 sq. inches) and has all the advantages of D-M-E's regular line of standards, it is claimed. Additional advantages include precision construction and the availability of standard component parts.

This series fits easily into an injection press having a tie bar clearance of only 8 inches and a maximum shut height of only 8½ inches. The increase



in cavity area without an increase in outside dimensions makes the A-R series a practical and more economical mold base for a wider range of molding jobs.

Another feature of the series is its adaptability for use in a variety of molding machines. Since the maximum shut height on many injection machines is limited, this series is available as a standard, with or without the rear clamping plate. This has been made possible by counterboring the screw holes in the bottom of the parallels and seating the rest buttons in the bottom side of the ejector bar. This arrangement allows the removal of the rear clamping plate without affecting the operation of the mold base in any way.

Made by DME, 6686 E. McNichols Road, Detroit 12, Michigan. **T-8-1211**

Hydraulic Pump

The Oil Hydraulics Division of the Webster Electric Co., Racine, Wis., announces the addition of the LB series to their line of gear type, hydraulic pumps. This pump is designed for a variety of uses, pressure lubricating, oil circulating, transfer and filtering systems, lift and replenishing systems.

The LB pump is available with three capacities, 2.5, 3.5 and 4.5 gpm at 1800 rpm. and 100 psi. Pressures or speeds in excess of these may be used satisfactorily in selected applications. The design of the LB pump permits use in

pumping most liquids with oil base.

The LB series consists generally of two types of pumps, type LBP and type LBS. Model LBP is designed for face mounting or wet sump application. Model LBS includes a shaft seal and is recommended for direct, gear or belt drives.

An internal relief valve, adjustable for pressures between 50 and 200 psi, is optional. It cannot, however, be used for a control or for pressure regulating.

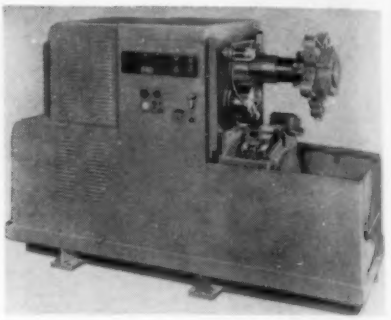
For more information, write to the Oil Hydraulics Div. of the Webster Electric Co., 1900 Clark St., Racine, Wis., and ask for Bulletin H1A3. **T-8-1212**

Pipeless Press

Single-Spindle Lathe

Designed for high efficiency operation in diversified production, the 2 a-c single spindle lathe features front and rear cross slides and a five-faced overhead turret, and handles work up to 10½ inches in diameter and up to 9 inches in turned length.

Trip-blocks are simply positioned in the slots of a pentagonal drum at the rear of the turret shaft to control feeds, spindle speeds, length of cutting stroke and skip indexing. Either or both cross slides can be selected to operate with any or all turret faces, and a quick Allen wrench adjustment controls late and dwell cross slide operation. Cam changes are thus done away with, and set up is speedy and simple.



For maximum rigidity, bearing surfaces on the turret shaft are limited to two, generously dimensioned and enclosed. By virtue of the overhead turret, customary tool overhang on larger diameter work is eliminated; instead, as work diameters increase, tools are brought closer to the guiding ways.

Setup controls include feed and speed selectors, automatic and hand operation switches, and forward, reverse and index push buttons. Operating controls include spindle and coolant control switches, and cycle start, motor start and stop push buttons. A 15-hp, 1660-rpm (full load) reversing motor is used.

Spindle speed range of the 2 ac is from 40 to 1102 rpm, and six automatically selected speeds are available in either of two ranges. Thirty-six feeds are available, from 0.0019 to 0.124 inch, from which six may be automatically selected.

Either or both of the 8-inch wide cross slides can be operated with any of the turret faces, feeding at the same rate. Maximum travel of the slide is 4½ inches. Rapid traverse and indexing brake permit fast approach strokes without danger to tooling.

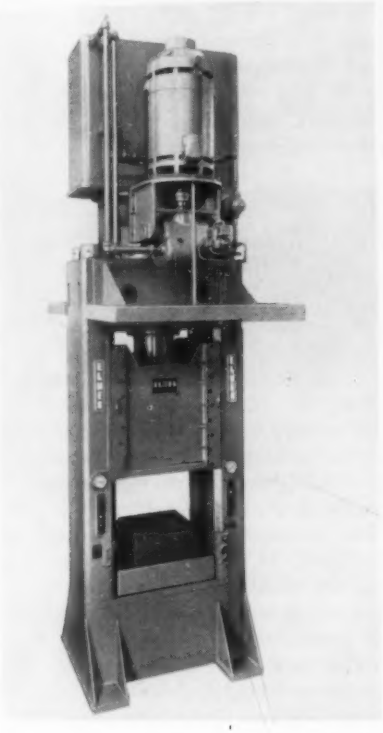
The lathe is made by The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3. T-8-1221

Adjustable Tap

The Landis special solid adjustable taps are provided for

Pipeless Press

The Elmes 500 ton hydraulic drawing and forming press is specially designed for cold drawing and nosing artillery projectiles. This press is part of a radically different shell-forging process representing the most efficient and economical compromise between old hot forging methods and the newest steel extrusion processes. The die has been made smaller than standard, the intense pressure developed in this process requiring less area.



This press embodies the Elmes principle of pipeless construction. There is no piping in the main hydraulic circuit. All high pressure fluid is conducted through short, direct passages drilled in the structural parts. The result is exceptionally smooth, quiet, shockless operation and remarkably low-cost maintenance, with down time practically eliminated. This particular press, in fact, is a double pipeless type, having two pipeless units for increased operating speed.

For further details, write for bulletins 1010-B and 1011 to American Steel Foundries, Elmes Engineering Div., 1150-Z Tennessee Ave., Cincinnati 29.

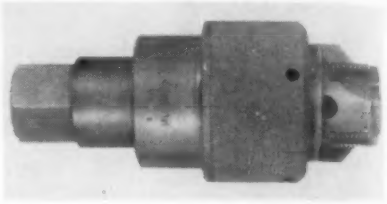
T-8-1231

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Adjustable Tap

The Landis special solid adjustable taps are provided for tapping and chamfering standard pipe and drainage fittings in one operation. They are now furnished in seven sizes, for pipe ranging from 1¼ to 4 inches, and are designed for application to Pottstown, Cleveland and other reversing spindle machines.

The feature of this Landis solid adjustable tap is the incorporation of chamfering blades in the tap body with the resulting savings of time, handling and capital investment due to the elimination of a separate chamfering operation. The use of removable tap chasers and chamfering blades, which can be easily and economically replaced after repeated regrinding, also lower tool costs and inventories.



The tapping operation is performed on the forward portion of the machine cycle while the chamfering is completed on the reversing segment of the cycle. This feature provides two notable advantages; it divides the torque load for smoother cutting with less strain, and supplies a chamfer without leave-off marks.

The taps will be furnished with square or hexagon end drivers or cylindrical shanks. Models are available for either right- or left-hand and straight or tapered tapping.

Made by Landis Machine Company, Waynesboro, Pa. **T-8-1241**

Weighing Unit

A line of self-contained, portable Emery hydraulic weighing units, accurate to 0.1 percent of scale, is now stocked in sizes up to fifty tons, according to an announcement by The A. H. Emery Co., New Canaan, Conn. The portable Emery weighing systems permit laboratory-accurate force measurement anywhere in the plant and on the job.

Portable units are now available in 24 ranges from 0-500 lb to 0-100,000 lb. There are four load cell sizes with a choice of 8½, 12, and 16-inch indicators.

Each unit contains a load indicator mounted directly on a hydraulic force-measuring cell. Simplified construction makes it rugged enough to stand up under the roughest in-the-field handling. Specially designed handles make the unit portable. **T-8-1242**

make all the tools and dies required for an ordinary model changeover. A few

Square ends

Technical Digests . . .

Tomorrow's Standard of Living

Production engineers are generally credited with a large contribution to the national standard of living. They will, no doubt, have an even greater responsibility for changes in the future. A question often arising is: How far is it possible to increase production per man by superior mechanization, by automation, without society going out of kilter? A discussion of such matters was conducted by the ASTE at its 1953 Annual Meeting in Detroit. Following are digests of views of the various participants in this forum:

Wartime Productivity

S. E. Bergstrom, vice president, The Cincinnati Milling Machine Company

There is more to the standard of living than just the material things in life. The cultural and spiritual phases mean a great deal in living standards. Bathtubs, automobiles, television sets, good clothes, etc. are not the entire measure of a standard of living. The development of the tastes of the more cultural phases of living certainly is a part of our over-all standard as well as our spiritual development.

Scarcity, whether caused by war or by any other force, always accelerates the development of certain research in order to overcome the scarcity. For example, during the war period there is scarcity of man power, so there are ways and means provided to do the same amount of work with the man power available. There is probably a scarcity of certain products, basic products. As of World War II, there was a scarcity in this country of dyestuff, so the dye industry accelerated its research.

After World War II high production continued. A scarcity of a certain type of man power persisted, so the engineering research and ingenuity of our engineers produced equipment and machinery that produced goods with less people.

If this country were suddenly able to safely liquidate the military establishment, there would probably be a slowing up of a certain amount of development because the need for acceleration would be missing. That is, unless business could continue to have the incentive to generate new ideas, develop new processes and produce more goods. Perhaps the profit motive would be a sufficient incentive. Under such circumstances, chances are that the progress in our standard of living would continue but would require some very definite incentives other than those brought about by scarcities and war.

One of the biggest contributions to our standard of living is the ability of our industry to increase its productivity by means of new methods. Just to cite an example: In 1910 or 1912 it took 162 machine tools to machine the four surfaces of a cylinder head and cost about 42¢ in 1912 money. In 1938 that same type of cylinder head, machined on all four sides, was produced on five machines for a total labor cost of about 21¢ Today that same cylinder head is machined on one machine in present 1953 dollars at the rate of about 4½¢. This economy was made possible because industry has been free to put back its earnings in new equipment and new methods, so they could produce better goods for less money for more people. That, of course, is also due to competition caused by good marketing and good merchandising.

Competition and Free Trade

R. H. Sullivan, vice president, Engine & Pressed Steel Group, Ford Motor Co.

In the automobile industry progress has been largely achieved through intense competition. My own company's attitude toward its competition is no secret—it is out to win the market. Unless this country is self-contained, some sort of trading is necessary and some means of balancing the national economy must be inevitable. A standard of living is tied to economic values. It is necessary to carefully consider our position with relation to the world markets in all phases of American industry. Our commitments, not only European, but world-wide, are necessary and are such that this country is going to have to put itself in the same position with the others. If, for instance, a high-tariff stand is taken because something could be made cheaply in Japan with low-labor rates, and can be exported and sold here for less than possible in Japan, the nation is going backwards. The country must look at this from a world viewpoint. It is necessary to develop through research and manufacturing ingenuity such potentials that, no matter what others do, the United States can still take its place and raise the standard of living, not only here, but also for other areas in the world, which are now on what may be called dole-type economy.

The principal question in this country is: What is the best way to bring about the greatest possible increased productivity? That is one of the reasons my firm has taken the stand in favor of so-called free trade. Ford Motor Company has had the capacity to

make all the tools and dies required for an ordinary model changeover. A few years ago, however, it was decided something was being lost by attempting to do that, so the tool and die capacity was deliberately reduced to a potential of no more than 50 percent of requirements. That made it necessary to go out into the independent field to cover the balance. It was thought in doing so, an increased contribution to productive efforts could be secured.

The introduction of many things that have been necessary or beneficial to the tool engineering profession, for example, has opened the door so that the contributions of industry as a whole, and certainly to the automotive industry, have been greatly enhanced. It has given an end result far greater than possible any other way. Tool engineers know, in the last few years particularly, there has been an evolution in the designing of tools, especially dies, and they are only one element. Years ago not much thought was given to the type and kind of lifters needed. The real limitation on the production of a punch press—say a toggle or triple-action press—was governed by speed with which a piece could be put in and taken out. Now the introduction of automation has entailed considerably more engineering skill, enabling operation nearer the possibilities of productive capacity of that machine. The United States is spending billions of dollars, according to reports, as contributions to other countries. If it were possible for them to produce to such economic advantage that the value of their goods would come closer to the amount of money contributed, then it would seem fundamental that they would get an increased standard of living. If their standard of living is raised automatically, it need not reduce the standard of living of the professions or the industries in this country.

Dissatisfaction and Progress

J. E. Weldy, Manager of Marketing, Carboloy Dept. of General Electric Co.

The standard of living cannot be held down because the typical American is filled with healthy dissatisfaction. He never likes things entirely the way they are now. He wants something better, whether it is his clothes or his home, his car or the machines that he is working with, and his business methods. That is the thing that has stirred, stimulated and caused the standard of living to grow in this country. It does not stand still. Americans are not complacent. They are dissatisfied. They want to make the head of an automobile engine on a machine tool for 4¢ not for 42¢. And they want to do it today.

As a result of that pressure, one is forced into newer, better, more efficient

best substitute. One low-grade ore will be in production soon if it

ways of using the available resources of materials, man power, time, money, and research.

One segment of American industry comes right up against that healthy dissatisfaction and it must be satisfied or go out of business. That is the marketing function that is a part and parcel of every American business. It takes the result of research and manufacturing, sells it to somebody at a profit and feeds the profit back for the incentive, the investment which has been said to be necessary to keep a business going. Marketing is usually thought of as the merchant who sells an automobile, electric clock, radio, or suit of clothes. But there is a tremendous area of marketing behind that, which takes place in the industrial field. This sells new processes, new ideas, new metals, new machinery to the companies that make the end products. The margin by which they are able to bring that better performance into industry determines whether better and newer end products are achieved, which will raise the standard of living throughout. The healthiest dissatisfaction extends all across the board in the consumer and marketing field.

Increased productivity is coming from something that should be recognized as a faster cycle of making progress, based on getting more information to industrial people faster than ever before. Many good ideas were introduced, 25 years ago, which took two, three, four, or five years before they began to be accepted, whereas, today when a new idea comes out, there is a matter of perhaps four or five months before people are using it, sometimes less. In the profession of tool engineering, this background of information, the interchange of knowledge through such societies as the American Society of Tool Engineers and the use of industrial and trade press to spread information has had tremendous effect in accustoming people to look for what is new. Again, this channel of industrial marketing is one of the important means that are acting to stimulate and encourage that interchange of knowledge. It is quite important, because many new concepts come along somewhat at the same time, and it is necessary to put them in proper relationship in order to make progress.

Research and Mass Production

Dr. H. E. Work, Research Director, New York University

Much has been heard about what the government has done for labor. Much has been heard about what labor unions have done for labor. Actually, research and mass production have done more to raise the standard of living of the average American than either government or the labor unions. It has been done by giving him more for his hour of labor. National resources are also an important part of the picture. Back in the 20's it was said that petroleum supplies would last for only eleven years. Today it is somewhere between 15 and 20 years. The time seems to be gradually increasing. A great deal depends on a combination of the work of physicists, geologists, geophysical prospectors finding oil where none was found before. Probably ordinary sources of gasoline will last us a few years more.

Meantime, industry and research organizations are finding ways for substituting other materials when present supplies are gone. It has been quite definitely proven that gasoline can be made from coal. Today it costs perhaps twice what it would cost to use natural gasoline. However, no one need fear that liquid fuels will cause any serious troubles in his lifetime. Another problem that has received a tremendous amount of research attention within the last ten years has been the question of iron ore. The whole basis of the steel industry is being changed. It formerly relied largely on dwindling Minnesota iron ores, high-grade ores dug directly from the ground and shipped to the blast furnaces. Considerable research has been in progress on making the next

best substitute. One low-grade ore will be in production soon if it is not already, and the magnetic ores in New York state are being used. There seems to be every indication that low-grade taconites will be developed also. Of course, some ores will be brought in from outside, but that involves long hauls and bringing the ore from foreign countries.

SUMMARY

Dr. R. P. Baker, vice president, Rensselaer Polytechnic Institute

Sometime ago we engaged in a great adventure. We attempted to provide the highest standard of living in the world for the greatest number of people. The problem is to find in a democracy the excellence that has always been associated with aristocracy. We shall find it in some way. Certainly looking back over the progress made in the past few decades, there is no reason for discouragement.

We are entering on what might be called the era of abundance, we can banish want, we can meet with increasing success the challenge of disease, we can simplify the tasks of the home, we can reduce manual labor, the demand for labor and the hours of toil. There are practically no limits to which we need set ourselves.

▼ ▼ ▼

Proposed Standards for NEMA A-C Motors, *S. H. Keller, Manager A-C Motor & Generator Application Engineering, Westinghouse Electric Corp. Buffalo, N.Y.*

Four questions arise in any discussion of the Rerating Program involving 1-30 horsepower a-c motors: (1) how is it possible to double horsepower output of a motor, yet keep physical dimensions essentially the same; (2) what will be the advantages to the machinery manufacturer who incorporates the motor into his product; (3) how does it benefit the user of motor-driven machinery; (4) just what are these suggested standards and when will motors using them be available?

Basically, the design engineer has four broad categories of components to work with to improve his motor designs: conductor, insulation, magnetic steel, and mechanical parts.

No one has found a more economical substitute or devised a method to increase the current carrying capacity of the copper conductor. However, the insulation, the magnetic steel, and the mechanical parts play a large part in the utilization of the basic conductor. It is the changes that have been made since 1938 in other materials that tell the story.

Varnished wire has been introduced and greatly improved in the past 15

Abstracts of
Foreign Literature

years. Paralleling the wire coating techniques, slot cell and phase insulation have made comparable improvements. An excellent example of this is the hermetic refrigeration motor.

By taking advantage of the much smaller space required by 1953 insulating materials, the useful copper that can be put in a given area has been greatly increased. This not only saves space, but the motor has insulation that withstands oils, chemicals, and other enemies much better.

Electric steel development has followed almost a parallel course. The amount of copper and steel required to obtain given field strengths for specified ratings of motor has been improved continuously. Treatments of the lamination to give more perfect interlaminar resistance has also added to the effective use of a given amount of steel.

Die casting of the aluminum squirrel-cage of the rotor was in its infancy in 1938. The pressures used today, along with improved bar insulation, give rotors of far superior quality.

Advances in the art of metal fabrication, from 1938 to 1953, is probably as big a factor in the new standards as all other improvements combined. During the war, great advances were made in the fabrication of steel so that much greater strength could be obtained from an equivalent mass of metal. Clever engineering in applying these advances in metal fabrication has changed the motor carcass from a necessary evil to a precisely designed housing.

The rerating program will have the following benefits for the machinery manufacturer: (1) the increase in horsepower per given size will bring motors in line with changes in his product during the past 15 years; (2) the motor will be a better product, because the standard line will incorporate all improvements made in the past 15 years; (3) economically, this rerating should reduce the tendency of electric motors to follow the basic inflationary curve, because superfluous metal that produces no horsepower will be eliminated.

Adopted standards to date are only on 1800 DP motors and a few dimensions. The rest of the information is close enough to adoption so that this can be used for preliminary work. Fine details should wait for final adoption of all standards. A suggested timetable has been set up that will make the first diameter, 182 and 184, available by the first of January 1954, and one diameter like the 214-215 available every five months thereafter.

From the 17th Annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corp., Pittsburgh, Pa., April 14 & 15, 1953.

Abstracts of Foreign Literature

By M. Kronenberg

Gear Vibrations

A new theory on gear vibrations has been developed by H. Strauch which he presents in an article published in No. 6, 1953 of *Zeitschrift des Vereins Deutscher Ingenieure*. The paper deals primarily with the derivations of mathematical formulas for vibratory amplitudes of gears and is based on the concept of the varying elasticity of a gear system due to the periodic changes in the engagement of one pair and two pairs of teeth.

The author indicates that vibrations are thus produced in conjunction with the inertia of the gears. He makes the assumption that the driving gear has infinite inertia (that is, he assumes that it is rotating at constant speed) while he elastic deformation is restricted to the driven gear. The formulas permit the calculation of the amplitudes of torsional vibration. The following quantities are taken into consideration as variables affecting the vibration: the type of engagement of the teeth, the damping capacity of the gear material, the natural frequency of vibration of the driven gear train and the gear speed expressed in rpm.

The author finds that, like resonance of rotating shafts, torsional gear vibrations—which often affect the accuracy and cause chatter marks on workpieces on machine tools—are smaller when a certain maximum speed is exceeded. Although this latter symptom is rarely observed in the machine shop, H. Strauch claims that it exists but is often hidden by other causes of vibration, such as defects in the pitch. In order to check the formulas and to determine some constants, it will be necessary to eliminate these additional causes for vibration. It will be possible to predict torsional gear vibration and to change the design accordingly when these overlapping conditions have been carefully studied.

German Patent Situation

A review of the present patent situation in Germany is given for the benefit of engineers in an article by G. Zennert in *Zeitschrift des Vereins Deutscher Ingenieure* No. 1, 1953. He discusses in detail the patent law of 1936 and what has been retained of it, in the new German patent statute

as approved by the U.S. High Commissioner. The regulations of the new German patent office, the four provisional regulations, the special legislation for West Berlin, the situation in East Germany are all discussed as are international agreements, the idea of establishing a super patent office covering all Western countries in Europe. It concludes with a bibliography of latest European patent publications.

Metal-Cutting Research

Shear angle in metal-cutting has claimed the interest of all those engaged in metal-cutting research for the past eighty years. Now it has been related to the shear plane theory, originally developed by O. Mohr, in a paper by H. Opitz and H. Hucks, published in the June, 1953 issue of *Werkstatts Technik & Maschinenbau*. The improved shear plane theory advanced by C. Torre has been applied by the authors to metal-cutting research to show that a secondary shear plane must exist, hitherto called the plane of crystal elongation.

They have derived from their theory a new formula for the shear angle and likewise a new formula for the material constant, which approximates Merchant's machining constant. The material constant depends only on the shear and compressive stress and varies with the material. For steel it is 45 degrees, for aluminum bronze, 36.8 degrees, for aluminum, 27.1 degrees, for copper, 37.4 degrees. The authors have developed their theory also for the three dimensional case and claim that the strees field in the chip must not be determined by cutting force vectors but rather with the aid of stress tensors, although it is necessary to measure the two or three cutting force components in order to be able to analyze the causes for the performance of cutting tools. Further research, however, will be required before this aim will be reached.

Coefficient of Friction of Lubricated Surfaces

G. Niemann & K. Banascheck have investigated the effect of surface finish, machining method, oil viscosity, etc. on the coefficient of friction of two stationary members pressed against a rotating face plate. Their report was published in *Zeitschrift des Vereins Deutscher Ingenieure of* February 21, 1953. In the case of running a blonze plate between two members of perlitic cast iron, the coefficient of friction was reduced from 0.035 to 0.010 inch when the stationary members were ground or polished instead of turned. Similarly, when the stationary members were

made of steel, the effect of various finishing methods was rather pronounced. Grinding gave relatively the roughest surface, polishing a better one and superfinishing the best. These differences, however, became insignificant when the relative velocity of gliding exceeded 200 in/sec.

The dimensions and the shape of the stationary members were so selected that the setup simulated the conditions of worm gears, roller bearings, and various similar machine parts where the coefficient of friction would be affected by the method of machining.

Apparatus for Machinability Testing

The Leyensetter pendulum and the Krystoff shear tester have been combined into one device with which resistance to cutting can be determined in a manner closely simulating actual cutting conditions. In this manner it would be possible to determine machinability factors in a short time, it is claimed by J. Schimanko in *Stahl & Eisen* of May 21, 1953.

The apparatus is also used for determining the wear of the cutting edge at various cutting speeds. A test consists of three operations—namely, two turning operations and a subsequent pendulum test, in which the energy is measured required for the removal of one cubic centimeter of metal. The first run, carried out on a lathe, is made for finding the cutting speed for the second run in which the wear is determined. The cutting speed is increased in increments of six fpm after every revolution until the first signs of wear are found on the workpiece indicated by the development of a burnished surface. In the second run a cutting speed 20 percent less than this critical speed is used until 10 (or 20) cubic centimeters of metal has been removed. The tool is then placed into the pendulum apparatus and its energy consumption compared with that of a highly polished and sharp tool, so the speed of the pendulum can be varied according to a cutting speed between 25 and 480 fpm. The pendulum test is repeated six to ten times and does not require more than about 30 minutes, including the lathe tests.

The author cites several examples of such tests showing substantial differences in machinability although other criteria, like tensile strength, did not show any difference between two steels of the same heat. The tests covered also the problem of finding the difference in machinability due to the direction of the fiber in the material. As a criterion for machinability it is suggested the materials be grouped by 5 percent increments in energy differences for the metal removal.

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	DESCRIPTION
A-8-143	B. C. Ames Co.	DIAL INDICATORS—Catalog No. 58 gives design details and application information on depth gages, amplifying comparators, micrometers and small hole gages, each with a dial indicator. (Page 143)
A-8-104	F. E. Anderson Oil Co.	COOLANT—An oil-free concentrate added to water makes this coolant. Case histories show how it removes heat fast, decreases the surface tension of water, and protects the machines and products from rust. The coolant reduces odor in machines. (Page 104)
A-8-177	Brush Electronics Co.	SURFACE ROUGHNESS GAGE—Bulletin on "Brush Surfindicator" gives information on making surface roughness measurements on the production line with portable instrument. (Page 177)
A-8-200	Cadillac Stamp Co.	MARKING DEVICES—Bulletin M-120 describes handmarking machine, air impact press, and hydraulic marking machine. Bulletin SE 130 describes miscellaneous items designed for all marking needs. (Page 200)
A-8-229	Campbell Machine Division, American Chain & Cable Co.	ABRASIVE CUTTERS—"Principles of Abrasive Cutting" gives solution of cutting problems and recommendations for faster and better operation. (Page 229)
A-8-186-3	Chicago Rivet & Machine Co.	RIVET SETTERS—Free catalog contains engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters. (Page 186)
A-8-33	The Cincinnati Shaper Co.	PUNCHING—Catalog B-4 explains the rapidity and accuracy of punching numerous holes in one operation, and ease of converting from one operation to another. (Page 32-33)
A-8-123	The Cleveland Cap Screw Co.	FASTENERS—Place Bolt Folder offers solution on vibration fastener problems through diaphragm spring action of bolt head. (Page 123)
A-8-136	The Cleveland Tapping Machine Co.	TAPPING MACHINES—Catalog TL-84 tells how to get maximum speed on larger bushings and meet a varied range of requirements. Also available is a booklet "Production Tapping Guide." (Page 136)
A-8-192	The Cushman Chuck Co.	AIR CHUCKS—Two catalogs, PO-64-1952 and 65-1952, give varied information in regard to Air Chucks; Cylinders and Accessories; and manually-operated chucks, respectively. (Page 192)
A-8-227	Danly Machine Specialties, Inc.	METALWORKING EQUIPMENT—Free bulletin, "Hydraulic Metalworking Equipment," describes hydraulic equipment built to special specifications for piercing, trimming, extruding and riveting. (Page 227)
A-8-185	Eastman Kodak Co.	HIGH SPEED CAMERA—The Kodak High Speed Camera can help solve problem of high-speed mechanical action or fluid flow. Full information offered in booklet. (Page 185)
A-8-139	Engis Equipment Co.	FINISHING COMPOUNDS—Technical bulletin No. T-853 describes a complete range of Hyprez-processed, pure diamond particle compounds. (Page 139)
A-8-20	Gisholt Machine Co.	MACHINE TOOLS—New general catalog describes complete line of turret lathes, and balancing and superfinishing machines. (Page 17-20)
A-8-179	Greenlee Bros. & Co.	SCREW MACHINES—Free literature gives details on quick and easy feed stroke adjustment and other features of automatics. (Page 179)
A-8-178-3	Grobet File Company of America	COUNTERSINKS—Catalog Sheet HC1 describes countersinks with six staggered cutting edges designed to eliminate chatter and give a shearing cut. (Page 178)
A-8-140	Hammond Machinery Builders	TOOL GRINDERS—Complete line of Carbide Tool Grinders for rough and finish grinding listed in new bulletin No. 235. (Page 140)
A-8-5	Hardinge Bros., Inc.	COLLETS—Bulletin No. 50 carries a useful reference list for Purchasing and Engineering Departments. Collets for all makes of lathes and millers are included with ordering information. (Page 5)

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

853 *THE TOOL ENGINEER, DETROIT 21, MICH.*

READER SERVICE CARD

Please send me further information as indicated below:

(Mark Key Number of trade literature, tools or advertisements)

ADVERTISERS	TRADE LITERATURE	TOOLS OF TODAY
A—	L—	T—
A—	L—	T—
A—	L—	T—
A—	L—	T—

NAME _____ POSITION _____

FIRM _____ BUSINESS _____

Please Check One ☐ Firm Address ☐ Home Address } STREET _____

CITY _____ ZONE NO. _____ STATE _____

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	DESCRIPTION
A-8-187	Jones & Lamson Machine Co.	DIE HEADS—Illustrated catalogs and complete information offered on die heads for automatics and small turret lathes; radial chaser type; and tangential chaser types, stationary and revolving. (Page 187)
A-8-144	Keller Tool Co.	AIR TOOLS—Literature offered covering information and specifications on power ratchet wrench. (Page 144)
A-8-8	The Landis Machine Co.	THREADERS—Bulletin No. E-88-1 gives information on Landis 4-spindle semi-automatic threader, which threads one machine bolt every 4½ seconds. (Page 8)
A-8-13	The Lapointe Machine Tool Co.	BROACHING—Bulletin DRH-5 gives detailed descriptions and specifications of all Lapointe Horizontal Broaching Machines, including Double Ram 15-ton size with 90-inch stroke. (Page 13)
A-8-234-1	Metal Carbides Corp.	TUNGSTEN CARBIDE—Catalogue 52-C offers data suggesting the advantages in using Talide for applications requiring maximum weight in minimum space. (Page 234)
A-8-122	Micrometrical Mfg. Co.	GEAR PROFILE CHECKER—Free bulletin, "Practical Features and Applications of the Profilometer" gives information on the importance of control of surface finishes in grinding operations. (Page 122)
A-8-170-1	Morton Machine Works	FIXTURE CLAMPS—Instructive illustrated catalog contains full-size templates of each product for tracing into any design. Size and type to meet most rigid requirements. (Page 170)
A-8-193	Oakite Products, Inc.	METAL CLEANING—44-page booklet, "Some Good Things to Know about Metal Cleaning," gives instructions on use of 16 new or improved materials for performing metal-cleaning jobs and related operations. (Page 193)
A-8-34	Ohio Crankshaft Co.	HARDENING & HEAT TREATING—"Typical Results of TOCCO Induction Hardening and Heat Treating" bulletin gives information on induction-hardening cylinder bores of conventional, cylinder-iron castings and other case histories. (Page 34)
A-8-125	O'Neil-Irwin Mfg. Co.	CUTTERS—32-page catalog gives complete details on hand and power-operated Di-Acro Rod Parters, Benders, Brakes, Notchers, Punch Presses, etc. (Page 125)
A-8-186-2	J. A. Richards Co.	BENDERS—Illustrated folder TE-5 tells how to produce without special tooling; save die costs and save on expensive presses by using a multiform bender. (Page 186)
A-8-180	The Rotor Tool Co.	CHIPPERS—Free Catalog 37 gives information on new Rotor chippers—lighter, shorter, more easily handled. (Page 180)
A-8-120	Siewek Tool Co.	FIXTURE CLAMPS—Free catalog No. 8 furnishes information on engineered fixture clamps, fixture components for tooling program, 160 sizes of drill jigs and free tracing templates. (Page 120)
A-8-194	Size Control Co.	GAGES—Catalog 53 tells how reversible plug gages give fast, accurate gaging at low cost. (Page 194)
A-8-190	Standard Pressed Steel Co.	SOCKET SCREWS—"Unbrako Standards" features the advantages of Standard socket screws over specials for most sheet metal assemblies. (Page 190)
A-8-108	Threadwell Tap & Die Co.	TAPS—56 pages of Tap information offered in "Tap Manual." (Page 108)
A-8-111	Tomkins-Johnson Co.	AIR CYLINDERS—Bulletin 8152 shows how to achieve high safety with less space in pushing, pulling, lifting, clamping or controlling jobs. (Page 111)
A-8-222-1	Tubular Micrometer Co.	MICROMETERS—Tumico catalog No. 22 shows many special purpose micrometers in wide range of styles and sizes to speed production and inspection. (Page 222)
A-8-189	Waldes-Kohinoor, Inc.	GROOVING TOOLS—New 20-page catalog offers descriptive, illustrated information and data charts, showing how the Waldes Truarc grooving tool can solve grooving problems. 17 case histories cover typical problems and solutions. (Page 189)

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

FIRST CLASS
PERMIT NO. 10782
(Sec. 34.9, P.L. & R.)
DETROIT, MICH.

THE TOOL ENGINEER
ASTE Building
10700 Puritan Ave.
Detroit 21, Mich.

ATT: READER SERVICE DEPT.

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

Another Cleveland Product

An open house

Field Notes . . .

At a special conference recently, during which the company held open-house for the industry, Kirke W. Connor, president of Micromatic Hone Corp., announced his firm's acquisition of Diesel Engineering and Manufacturing Corp. Two immediate advantages gained from the transaction are Demco's backlog of about a year's production which reflects additional earning power, for Micromatic and the new manufacturing facilities to be provided Demco which will permit a major increase in its business.

Demco, was founded in 1940 by Nicholas Fodor who worked out technique for manufacturing diesel fuel-injection systems and jet engine fuel-flow controls that permit mass production of these parts to extreme tolerances. The company also is engaged in manufacturing tailor-made hydraulic components for jet aircraft.

Mr. Connor, in making the announcement, said the acquisition of Demco represented the end of a 22-year search by Micromatic for a straight manufacturing subsidiary that could be integrated readily into a machine tool company. The new acquisition, Mr. Connor pointed out, is expected to provide substantial growth in fields not normally attractive in the machine tool industry.

The deal was effected by exchange of stock—14,428 shares of Micromatic for all of the equity of Demco on the basis of book value.

• • •

Jack G. Kehoe has been appointed manager of Chrysler Airtemp Dayton sales region, according to a recent announcement. He joined the Chrysler Corp. in Detroit in 1941 and has held sales and personnel training positions in Detroit and Evansville with the Airtemp Division since 1946.

• • •

The Kold-Hold Mfg. Co. of Lansing, Mich., manufacturer of refrigeration equipment and products in the industrial and domestic heating fields, has announced a change in its corporate name to Tranter Mfg., Inc. The change was voted by stockholders who felt that the Kold-Hold name was made inappropriate as the result of a well-established product diversification program. James R. Tranter, Kold-Hold president and general manager who will continue in the same capacities in the company that now bears his name, pointed out that the name change will have no effect on ownership of the firm or its corporate structure.

Nick S. Deanovich is now Texas representative of the Gisholt Machine Co. of Madison, Wis. Associated with the firm for nearly 15 years, he has served as a machine operator, foreman and supervisor and has traveled throughout the United States, Mexico, Canada and Europe as a member of the sales staff. His office is located at 4101 San Jacinto in Houston.

• • •

Three appointments have been announced by Mechanical Air Controls, Inc., Detroit, Mich. Jack L. Modrich, formerly sales manager for Miller Motor Co., is now general sales manager. Edward L. Rogers, named chief engineer by the company, was previously associated with the Ford Motor Co., Vickers, Inc., and Superdraulic Corp. Larry Newton, formerly with Ford and Wilson Machine Products, was appointed purchasing agent.

• • •

Electro Arc Sales Co. has been formed to handle distribution and service of Electro Arc metal disintegrators. The new company included former sales representatives of the Electro Arc Mfg. Co. and has 20 engineering sales offices throughout the United States. T. J. O'Connor is president and manager, with headquarters at 5270 Geddes Road, Ann Arbor, Mich.

• • •

Five production engineers have been appointed to represent the recently formed Shear-Speed Chemical Products Division of Michigan Tool Co., Detroit. They are: E. W. Brock, 5657 Montgomery Rd., Cincinnati 13, southern Ohio and Kentucky; H. O. Monohan, 1007 Yale Ave., St. Louis 17, Missouri, southern Illinois and eastern Kansas; C. B. Parsons Co., 739 N. Broadway, Milwaukee 2, Wisconsin; Polhemus-Miller Co., 9 S. Kedzie Ave., Chicago 12, northern Illinois and eastern Iowa; and D. C. Wedlick, 401 Willow Lane, Muncie, east-central Indiana.

• • •

Kennecott Copper Corp. will develop a new open-pit copper mine in Nevada, according to an announcement made by Frank R. Milliken, vice president in charge of mining operations. Development work will start in the near future and full production is expected to be attained in 1954. This is the second major development undertaken recently by Kennecott in this area to add to the country's production of the vital red metal.

An open house commemorating the opening of a new mill-branch warehouse and office for The Carpenter Steel Co. in the San Francisco Bay area was held recently at Belmont, Calif. D. J. O'Neill, Pacific coast manager, is in charge of the Belmont headquarters.

• • •

A $2,000,000 expansion program, announced by L. A. Lindberg, president of Lindberg Steel Treating Co., will include a new plant now under construction on a six acre tract of land at Melrose Park, Ill. The one-story structure, which will double the company's heat treating capacity to more than 50 million pounds annually, will be the world's largest heat treating plant. It will handle materials and parts valued at $600,000,000 during each 12-month period.

• • •

Formation of the Inspection Equipment Co., affiliated with Associated Designers of Birmingham, Mich., was announced recently by Duane Carlington, Associated executive vice president. Activity of the new company will be to manufacture, reproduce and market optical comparator charts on glass, plastics, steel, aluminum, brass or other materials.

• • •

A new clad metal plant which will produce gilding metal clad steel strip for bullet jackets for the United States Army is ready for full scale operation by Superior Steel Corp. Built and equipped jointly by Superior and the Ordnance Corps at a cost of $7,757,865, the plant will operate under new methods and processes which are expected to save the government between $100 and $150 a ton. Announcement of the new facilities, which will increase Superior's clad metal capacity from 30,000 tons to approximately 80,000 tons per year, was made jointly by Carl I. Collins, president of the company, and Col. J. B. Goodell, military chief of the Pittsburgh Ordnance District.

• • •

Link-Belt Co. has appointed Harvey V. Eastling as assistant general manager of its Pacific Division, with headquarters at San Francisco. Formerly general manager for the division, Mr. Eastling has also served as chief engineer at San Francisco and manager of engineering sales at Seattle.

• • •

Henry B. Reich, formerly senior buyer of tools, dies, fixtures, jigs, gages and cutting tools for the Ford Motor Co., is now the sales engineer for the United Tool & Die Corp., Detroit, Mich., manufacturers and designers.

Who's Meeting - and Where

Aug. 10-21. Massachusetts Institute of Technology. Special Summer program in Industrial Photoelasticity, Dept. of Mechanical Engineering, Cambridge, Mass. Detailed information available from the Summer Session Office, Room 3-107, Massachusetts Institute of Technology, Cambridge 39, Mass.

Aug. 17-19. Society of Automotive Engineers. International West Coast meeting. Georgia Hotel, Vancouver, B. C. Additional details may be obtained from the society at 29 W. 39th St., New York 18.

Aug. 19-21. Western Electronic Show & Convention. Civic Auditorium, San Francisco. Write to headquarters at 1355 Market St., San Francisco, for particulars.

Aug. 23-26. National Automatic Merchandising Assn. Convention & Exhibit. Conrad Hilton Hotel, Chicago. For more information contact association headquarters at 7 S. Dearborn St., Chicago. C. S. Darling, Secy.

Aug. 24-28. Massachusetts Institute of Technology. Special Summer program in Strain Gage Techniques, Dept. of Mechanical Engineering, Cambridge, Mass. Full details may be secured from the Summer Session Office, Room 3-107, M I T, Cambridge 39, Mass.

Aug. 24-28. First Western X-ray Diffraction School. Will be conducted by North American Philips Co., Inc. at Sir Francis Drake Hotel in San Francisco. For registration contact a Philips dealer or the Research & Control Instruments Div., 750 South Fulton Ave., Mount Vernon, New York.

Sept. 1-4. American Institute of Electrical Engineers. Pacific general meeting. Hotel Vancouver, Vancouver, B. C. For further information contact the institute at 33 W. 39th St., New York 18.

Sept. 4-13. European Machine Tool Exhibition. European Committee for Cooperation of Machine Tool Industries. Brussels, Belgium. For complete details contact any Belgian Consulate.

Sept. 6-11. American Chemical Society. Fall meeting, Hotel Conrad Hilton, Chicago. More details are available from the society office, 1155 Sixteenth St., N.W., Washington 6, D.C.

Sept. 13-16. Electrochemical Society. 104th Meeting, Corrosion Division. Wrightsville Beach, North Carolina. Additional information available from the Secretary, 235 W. 102 St., New York 25.

Sept. 14-17. International Congress of Industrial Design. Paris, France. Inquiries should be addressed to the Secretariat General, 28, rue Saint-Dominique, Paris, 70 *(Congress International d'Esthetique Industrielle)*.

Sept. 14-18. Industrial Engineering Conference. Fifth Annual Meeting Michigan State College, East Lansing, Mich. Write Prof. James M. Apple, Dept. of Mechanical Engineering for full conference program and registration.

Sept. 16. Society of the Plastics Industry. Midwestern Plastics Conference. Gold Coast room, Drake Hotel, Chicago. Detailed information can be secured from G. M. Basford Co., 60 E. 42nd St., New York 17.

Sept. 21-22. Steel Founders' Society of America. Annual fall meeting. The Homestead, Hot Springs, Va. Address the society 920 Midland Bldg., Cleveland for further information.

Sept. 28-30. Association of Iron & Steel Engineers. Annual convention. Hotel William Penn, Pittsburgh. More information is available at association offices 1010 Empire Bldg., Pittsburgh.

North East West South IN INDUSTRY

Promotion of two officials of the **Kennedy Valve Mfg. Co.** has been announced. **Carl H. Morken,** formerly works manager, has been appointed vice president in charge of manufacturing, and **Thomas S. Turkington,** controller, has been given the additional responsibilities of secretary.

The **Timken Roller Bearing Co.** has announced a series of promotions brought about by the retirement of **J. A. Riley,** secretary-treasurer. **H. E. Markley** is now secretary of the firm, **G. L. Deal,** treasurer, **B. R. Powell,** assistant secretary, and **R. A. Gulling,** assistant treasurer.

Four new vice presidents have been elected by the directors of **Thor Power Tool Co.,** Aurora, Ill. **J. A. Hill,** a member of the firm for 33 years, was named vice president and sales manager. **John A. McGuire** retains his present title of chairman of the executive committee and in addition becomes vice president in charge of labor relations. **B. H. Johns,** after a career of 27 years in heading up company branches in St. Louis and Philadelphia, and as sales manager of the Contracting and Mining Division, was named vice president in charge of rock drill sales. **W. B. Hunn,** with Thor for 18 years, was elected vice president in charge of the company's Los Angeles Works.

Robert F. Smith has been elected president of **The Indiana Steel Products Co.,** Valparaiso, Ind., world's largest producer of permanent magnets. A veteran of 16 years' service with the company, he was formerly vice president and general manager.

Robert F. Smith

Edwin W. Shipman

Edwin W. Shipman has been elected vice president and manager of the Licensee Division of **Illinois Tool Works, Chicago.** He joined the company more than 25 years ago, beginning work in the sales department, and has been connected with licensee activities since 1939.

Clarence J. Johnson, corporate secretary of **American Machine & Foundry Co.,** has been elected secretary and a director of Thompson-Bremer & Co. of Chicago. He is also secretary of International Cigar Machinery Co. and other AMF subsidiaries.

Russell P. Folland has been named vice president and general manager of **Monarch Products Co.,** Hazel Park, Mich. In his new capacity, he will assume complete charge of operations for both the engineering and tool and die divisions of the company.

Two promotions were announced recently by the **Sharon Steel Corp.** when **James A. Roemer,** operating head of the Niles Rolling Mill Division since 1935, and **John J. Kraus,** district manager of the Detroit Sales office, were named vice presidents.

According to an announcement from **Illinois Tool Works, James R. Russell** has been elected secretary of the company. He has been assistant treasurer, a position he has held since 1945 and will continue to occupy in his new capacity.

The American Safety Razor Corp. of Brooklyn, N. Y., announces the appointments of **Donald D. Mallory** as director of engineering and **Wayne M. Biklen** as manager of quality control. Mr. Mallory was formerly in charge of engineering at the Toledo Scale Co. Mr. Biklen has been associated with the W. A. Sheaffer Pen Co. for the past 18 years, the last eight years as manager of quality control.

Phillip R. Heim has been elected to the board of directors of **Vard, Inc.,** Pasadena, and appointed vice president in charge of manufacturing. A member of the American Society of Tool Engineering, he has been associated with Vard since 1950.

Joseph A. Conlon has been appointed vice president of the **New York Belting and Packing Co.,** succeeding **Ben F. Reuther,** who has retired after more than 48 years in the rubber industry. Mr. Reuther will continue in an advisory capacity. Named vice president in charge of sales in 1952, Mr. Conlon will function as the company's senior operating executive.

Correction: R. B. Tripp was elected to membership on the executive committee of the **American Gear Manufactures Association,** not executive vice-president. The July issue should have read **R. B. Holmes** was elected to this office. **The Tool Engineer** regrets this error.

OBITUARIES

Gail E. Barr, superintendent of the Natrona, Pa., plant of the **Pennsylvania Salt Mfg. Co.,** died recently after a brief illness at his home in Freeport. He was 56. Mr. Barr, who joined Pennsalt in 1912, first worked in the Natrona plant laboratory. He later became process supervisor and product supervisor and in 1948 was promoted to superintendent.

John E. Powell, application engineer for **Worthington Corp.,** died recently at Wellsville, N. Y. He had served in the Steam Turbine Division at the Wellsville Works since 1944. He began his career with the company in 1927 in the Export Department and later moved to the Centrifugal Pump Division. He subsequently transferred to the Boston District office as sales engineer and later to the Providence, Rhode Island District office as manager.

Sumner Simpson, 79, board chairman of **Raybestos-Manhattan, Inc.,** died recently at Bridgeport, Conn. He was an industrial and civic leader who for many years has been rated as Bridgeport's number one citizen. Self made, he started in the automotive business early in the century with Royal Equipment Co. The firm was soon known as Raybestos and through a merger in 1929 became Raybestos-Manhattan, Inc. Mr. Simpson was its only president until a few years ago when he became chairman of the board.

Technical Shorts . . .

METALS MANY times stronger than those now in use may be coming on the horizon. Clues to this possibility are the tiny but perfect crystals produced in the General Electric Research Laboratory, where two G-E scientists have made microscopic crystals of zinc, zinc sulfide and mercury without the defects which are usually present. Revelation of the fact was made recently by Dr. J. Herbert Hollomon, manager of the Metallurgical Research Dept. of the laboratory as he spoke recently before the New England Regional Conference of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers.

X-ray tests, as well as photographs made at high magnification, show the crystals to be virtually perfect, he said. From the extent which they may be bent and still spring back, it is possible to measure the stresses to which they are subjected. This shows them to be far stronger than ordinary crystals, he added.

Dr. Hollomon pointed out that work on defects in crystals is now assuming great importance both in the laboratory and the world at large. Metals, as used ordinarily, consist of crystals, and there are usually defects in the regular arrangement of the atoms of which they are built. He added that theory indicates an increase in metal strength of as much as a thousand times if such defects are eliminated.

The department which Dr. Hollomon heads is engaged in a broad program of research in this field to find out why metals both in pure form and alloyed with other metals, behave as they do. In connection with these studies, Dr. Walter Roth and Dr. W. W. Piper produced the crystals without defects. Their work confirmed earlier work at the Bell Telephone Laboratories where similar crystals of cadmium and tin had been made, Dr. Hollomon explained. Dr. Gerald Sears, in the General Electric Research Laboratory, has grown similar fine fibers of mercury and zinc.

He also told of work in crystal growth, which has been found to take place in a helical direction, similar to that of a spiral staircase. When a crystal forms, successive layers of atoms are built up. It had been a puzzle, he said, as to how, when one layer had been laid down, the crystal was able to start another. Now it turns out that a layer is ordinarily never entirely completed, but advances in a spiral, continually getting higher. Studies at G. E. now have fully confirmed this discovery.

Dr. Hollomon also stated that materials used both in permanent magnets and electromagnets also involve defects. Such magnetic material consists of a great number of minute "domains." Each of these is a magnet, but they counteract each other. When the material is magnetized, the boundaries between these domains, which are literally defects in the crystal arrangement, shift a little. Some domains get smaller while others get bigger, so that they predominate.

He expressed the view that further knowledge of this effect and its application may lead to far better magnetic materials than any now available.

* * *

A NUMBER OF PATENTS owned by the U. S. Government and held by the Atomic Energy Commission have been transmitted to the U. S. Patent Office for registry and listing in the official register of patents.

As part of its program to make nonsecret technological information available for use by industry, the Commission will grant nonexclusive, royalty-free licenses on these patents. Commission-held patents and patent applications released for licensing now total 565.

Included in the group are several methods and processes of particular interest to engineers and metallurgists in the tool and allied fields.

Patent No. 2,633,740 on a leakage testing method describes an efficient and reliable method for testing a jacketed body for airtightness, particularly the seam weld that seals the portion forming a jacket.

Preparation of powdered thorium is covered by patent No. 2,635,956. It deals with a process for converting massive metallic thorium to powder metal. First, the massive metal is treated in a furnace with hydrogen at slight superatmospheric pressure and a temperature of 600 to 650 degrees C. to form a lower hydride of thorium, ThH_2. The introduction of hydrogen is continued while lowering the temperature slowly to about 100 degrees C., thereby forming a loosely packed powderlike compound of ThH_{3-4}. Subsequently, the introduction of hydrogen is discontinued, the furnace is evacuated, and the temperature raised to about 700 degree C. while maintaining vacuum.

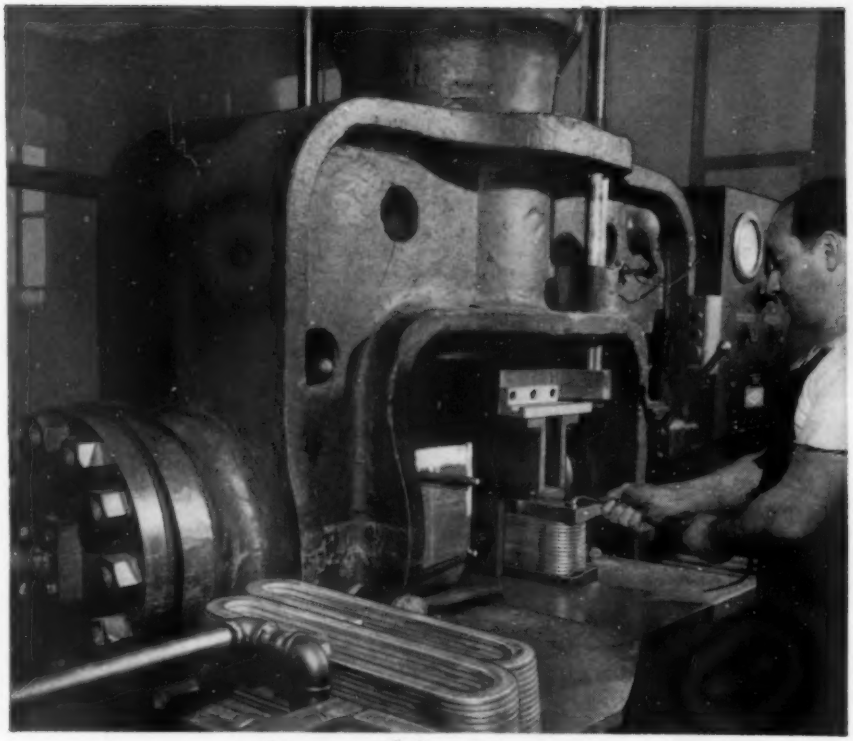
An improved apparatus for attaching a filament to an electrode is titled Apparatus for Attaching Filaments to Electrodes in Machines for Coating with Metal Vapors and is covered by Patent No. 2,637,297. It appears particulary useful in the hot-wired method of preparing metals, such as zirconium, by the thermal decomposition of a volatile halide.

A fourth in the list of patents is No. 2,637,882, covering vacuum die-casting. It describes a new and improved design for a die casting machine of the evacuable type, employing an air tight sealing member that will maintain an effective vacuum tight seal without the necessity of applying any pressure thereto by either die section. The arrangement is such that the seal remains relatively cool and thereby substantially free from the deleterious effects caused by heat.

* * *

A STAINLESS ALLOY, V2B, which is said to combine high hardness, nongalling characteristics, and superior corrosion resistance has been developed by Chief Chemist and Metallurgist Norman S. Mott of the Cooper Alloy Foundry Co.

V2B is a hardenable 18-8 type of stainless steel, containing copper, molybdenum, silicon and a very small amount of beryllium. The makers describe it as readily machinable in the quench-annealed state, and say it may be hardened by a low temperature heat treatment which produces no distortion and only a light heat tinting discoloration, which may be readily removed if necessary. In the annealed condition, the material is easily welded using special welding rods. In addition to its use in a variety of corrosive applications,



How this 2-way

FARQUHAR Hydraulic Press

forms motor and generator coils

In producing motor and generator coils from ¼ x 1-in. copper stock, the stock is first bent and the ends laminated, and then pressed to restore them to their original thickness. Then, the coil is put in this Farquhar 2-way Hydraulic Press for "pressing" the form.

The coil is laid on a steel block, a three-part filler mandrel inserted, and a top block applied. The press "snugs" the coil sides at low pressure (40 tons); then the vertical ram snugs the top. The operator kicks the pressure-shift pedal, to double vertical-ram pressure for forming.

Capacities of rams are 100 tons horizontally and 200 tons vertically. Illustration above shows operator withdrawing the coil after forming has been completed.

Farquhar Presses Cut Your Costs

The above installation is just one more example of Farquhar performance in heavy production! Farquhar Presses are built-for-the-job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of the extra guides on the moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost!

Farquhar engineers are ready to help solve whatever production problem you may have. Their expert assistance is yours for the asking. Give them a call . . . at no obligation, of course!

Or, send for our free catalog showing Farquhar Hydraulic Presses in all sizes and capacities for all types of industry. Write to: THE OLIVER CORPORATION, A. B. Farquhar Division, *Hydraulic Press Dept.*, 1519 Duke St., York, Pa.

where its high hardness and nongalling features are required, V2B, unlike other precipitation hardenable alloys, does not over-age at elevated temperatures and may therefore be used safely in steam applications and at temperatures up to 1400 F.

Claims are that in the hardened condition its resistance to sulphuric, hydrochloric and phosphoric acids and their salts, exceeds that of all precipitation hardenable alloys, and even that of type 316, the molybdenum bearing stainless alloy.

V2B may be produced readily in both the cast and wrought form, with the following balanced composition range considered best for the majority of applications.

Carbon	<.07
Chromium	19.0-19.5
Nickel	9.75-10.25
Silicon	2.75- 3.25
Copper	2.0- 2.25
Molybdenum	3.0- 3.50
Manganese	0.50- 0.75
Beryllium	0.10- 0.20

Typical Brinell hardness and mechanical properties of the alloy produced to this composition are as follows: As cast, 302; quench annealed, 269; annealed and hardened, 363.

Its mechanical properties include: tensile strength, 151,000 psi; yield strength, 122,400 psi; elongation, 3 percent; reduction of area, 2 percent.

* * *

RECENTLY, A SIMPLE method of removing the metallic zinc coating which deposits on deburring stones when zinc die castings are barrel-deburred has been perfected by the Magnus Chemical Co., Inc. As an example of the process in operation, a mid-western barrel finishing shop formerly was using a synthetic white stone as a deburring medium. It took nearly an hour and a half of tumbling with caustic soda to remove the zinc deposit.

Now, using the new process the chips are completely cleaned in 20 minutes. Several hundred pounds of the contaminated chips are placed in the barrel with enough water to come to the top of the load. Two-thirds pound of the Magnus D-Scale-R is added, and the barrel is run for 15 minutes. After thorough rinsing with water in the barrel, about 2 lb of an alkaline cleaner is added, and the load tumbled for 5 minutes to neutralize any remaining traces of the descaling product.

A solid, inert material, the D-Scale-B does not produce acid action until dissolved in water, making it safe to ship, handle and store.

There are discussions which bri

Good Reading

A GUIDE TO SIGNIFICANT BOOKS AND PAMPHLETS OF INTEREST TO TOOL ENGINEERS

ENGINEERING DRAWING, *by Frank Zozzora. Published by McGraw-Hill Book Co., 330 W. 42nd St., N. Y., Price $5.00, 369 pp.*

This engineering drawing text book is designed to meet the needs of students and practicing engineers, and to satisfy industry's desire for drawing courses stripped of nonessentials. As a text it discusses fundamentals without requiring the student to learn specialized details that will be of little value in later work. Engineers will find it useful for reference and review of basic procedures.

Contained in this book are over 700 annotated illustrations. Use of pictorials accompanied by corresponding orthographic views aids students in visualizing three-dimensional relationships. Also included are problems of varying degrees of difficulty.

No attempt has been made to cover in detail the specialized fields of architectural drawing, aircraft drawing, jigs and fixtures, charts, graphs, perspective, and illustration.

An appendix is included containing tables and design information on commonly used fastening devices, on the classification of fits, and on other related matters. Also included is a bibliography of texts, pamphlets, and ASA Standards.

HISTORY OF STRENGTH OF MATERIALS, *by Stephen P. Timoshenko. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y., Price $10.00, 451 pp.*

Here is a book for students of engineering who, having knowledge of strength of materials and theory of structures through courses in those fields, wish to pursue further information. Presented in this book is a history of the development of the science of strength of materials from its beginnings to the present.

Handled chronologically, the text treats the developments of the sciences by periods of history. Within these periods, major contributions made by prominent scientists and engineers are related in brief biographies.

There are discussions which bring together present developments in the field of strength of materials. These considerations include the modern effects of railroad transportation, the use of steel as a major structural material, and the development of combustion engines and light airplane structures.

DESIGN OF MACHINE ELEMENTS, *by M. F. Spetts. Published by Prentice-Hall, Inc., 70 Fifth Ave., N. Y., Price $9.65, 504 pp.*

Designed as a college engineering text, this book attempts to instill a professional viewpoint in the student in preparation for meeting actual conditions found in practice. Included are many problems, answers to which are supplied, to aid in acquiring a working knowledge of the theories presented.

As the title indicates, this book deals more with fundamental principles required for the correct designing of the separate elements which compose machines than with broader aspects of the design of complete machines.

The text covers such machine design topics as: working stresses, shafting, springs, belts, clutches, brakes, lubrication, bearings, gears, dimensioning, and engineering materials.

ANALYSIS OF ALUMINUM ALLOYS, *by G. H. Osborn and W. Stross. Published by The Chemical Publishing Co., Inc., 212 Fifth Ave., N. Y., Price $3.50, 144 pp.*

This book is the outcome of a concerted effort by the chemists of a group of firms specializing in the refining of secondary aluminum. It surveys analytical methods, many of which are new, others are modified versions of known methods, and a few are established standards. Methods range from these requiring modern physicochemical instruments, such as a polarograph and photometer, to those which may be carried out with the normal equipment available in the general chemical laboratory. Every method has been thoroughly tested by extensive application in industrial laboratories. Details of procedure have been supplemented, where necessary, by theory.

The book lists gravimetric, volumetric, electrolytic, photometric and polarographic methods for the determination of the most common elements, such as copper and magnesium.

Methods for the determination of less common elements such as beryllium bismuth, calcium, silver, and sodium are also described.

TRADE LITERATURE

For Free Booklets and Catalogs—Convenient Request Card on Page 133

Heat Treating Furnaces

Recirculating heat treating furnaces are presented in 12-page Bulletin 81. Numerous photos show the line in various operations, while drawings explain both the design of the equipment and the details of its operation. Tables give detailed specifications for pot, batch and conveyor type furnaces. **Despatch Oven Co.**, 619 S. E. 8th St., Minneapolis. **L-8-1**

Power

Folder describing application of air and hydraulic power displays condensation of complete line of valves and cylinders, pointing out simplicity and economy of these types of power for replacing manual operation. **Rivett Lathe & Grinder, Inc.**, Brighton 35, Boston, Mass. **L-8-2**

Grinding

Second edition of popular 84-page booklet on better grinding gives up-to-date information on how to set up jobs, operate and care for precision cylindrical grinders, and how to turn out better grinding jobs. Discusses basic grinding facts as they pertain to cylindrical grinders, and more than 90 illustrations serve to clarify points and dramatize operations. Information applicable to all makes of cylindrical grinding equipment. **Landis Tool Co.**, Waynesboro, Pa. **L-8-3**

Finishing

Brochure deals with company's services and products for finishing industry; describes in detail with particular attention to its special-problem studies and recommendations regarding metal cleaning, phosphating, paint stripping and paint booth operations. Also focuses attention on line of standard products specially developed to handle specific metal-finishing jobs. **Pelron Corp.**, 7714 W. 47th St., Lyons, Ill. **L-8-4**

Broaching

Wealth of practical information resulting from 25-years' experience in the field is assembled in illustrated 80-page book "Broaching Practice"; covers such points as classifications of broaching, applications and limitations, definition of terms, cutting action as compared to other cutting tools, broachability of various materials, design and manufacture. Available to key personnel of plants in metalworking field. Request on company letterhead directly to **National Broach & Machine Co.**, 5600 St. Jean, Detroit 13.

Grinding and Lapping

Illustrated brochure 1843-12 gives information on complete and varied line of cylindrical, crankpin cam and shape, tool room, universal and surface grinders, and lapping machines; each model is pictured and also is accompanied by a description of its main design and construction features and information on its operation, and a table outlining its dimensions. **Norton Co.**, Worcester 6, Mass. **L-8-5**

Steel

Concise, pocket-size booklet deals with cold finished fine steels, their uses, recommendations for their heat treatment by different methods, specifications for various types. Includes pertinent information such as decimal equivalents, wire gage comparisons, hardness conversion table, recommended practice for various operations and of industry definitions. **Pittsburgh Tool Steel Wire Co.**, Monaca, Pa. **L-8-6**

Packings

Sixty-page manual 201 offers data on leather and synthetic rubber packings. Divided into three sections, covers development, standardization and types of hydraulic and pneumatic packings; importance of leather as packings material; and natural and synthetic rubber packings. Each includes application and dimensional data. Mechanical drawings illustrate information; 39 tables include latest dimensions approved by or recommended to, JIC, as well as tables of sizes and proportions not covered by JIC. **Graton & Knight Co.**, 356 Franklin St., Worcester 4, Mass. **L-8-7**

Desegatized HS Steel

Informative brochure deals with Electrite, Double Six M-2 Desegatized high speed steel; gives typical analysis of this steel made to customer's specifications, lists uses, describes its qualities and advantages, and offers recommendations for working; also includes tables and graphs giving tempering data. **Latrobe Steel Co.**, Latrobe, Pa. **L-8-8**

Gages Dial Bore

Bulletin 53 covers complete line of dial gages; illustrated by photos and drawings; includes specification table. **Boice Mfg. Co.**, Staatsburg, N. Y. **L-8-9**

Barrel Finishing

Sixteen-page manual explains "Honite" barrel finishing method for deburring and burnishing small metal parts; discusses choice of proper size barrel finishing chips for specific operation, and selection of correct "Honite" compound for each. Ten of the compounds are described, with purpose, characteristics and metals for which recommended, and prescribed mixture for each. **Minnesota Mining and Mfg. Co.**, 900 Fauquier St., St. Paul, Minn. **L-8-10**

Welding Alloys, Fluxes

Folder, "How to Use and Apply the All-State Alloys and Fluxes Contained in the Doc Alloys Kit" presents in condensed form technical instructions (written in easy-to-follow lay language) for applying eleven of company's line of alloys and their companion fluxes. **All-State Welding Alloys Co., Inc.**, White Plains, N. Y. **L-8-11**

Screw Threads

Vol. IV, No. 2 of "Die Headlines" explains the importance of proper alignment when cutting screw threads and how misalignment may be checked. Well illustrated to clarify main points. **The Eastern Machine Screw Machine Corp.**, Truman & Barclay Sts., New Haven 6, Conn. **L-8-12**

Rotary Tables

Ten-page brochure deals with line of precision rotary tables, emphasizing speed, accuracy and dependability. Shows plain, tilting and vertical models in close-up pictures for examination, and also in action in various applications. Includes specifications. **Pratt & Whitney**, Div. Niles-Bement-Pond Co., West Hartford 1, Conn. **L-8-13**

Electronic Drives

Informative 12-page bulletin D-2102 describes and illustrates improved electronic adjustable-speed drives from ¾ to 3 hp designed for powering small industrial equipment; comprehensive but concise; points out special features by showing them during operation. Hole-punched for reference filing. **Reliance Electric & Engineering Co.**, 1111 Ivanhoe Rd., Cleveland 10. **L-8-14**

Threading Tools

Rotating and non-rotating radial and tangent die heads solid adjustable, machine and pipe taps, chasers and accessories as well as special threading tools are pictured and described in Catalog No. 153. Engineering drawing and specification table included for each type tool. **Murchey Div., The Sheffield Corp.**, Dayton 1, Ohio. **L-8-15**

Alloy Spring Steels

Eighteen-page reprint Transactions of the A.S.M. offers charts, tables and photo-micrographs to illustrate paper which compares the mechanical properties of three alloy steels—nickel-chromium-molybdenum, silico-manganese and plain carbon spring steel. **The International Nickel Co., Inc.,** 67 Wall St., New York 5. **L-8-15**

Hole Punching

Illustrated catalog C describes company's types C, E and EJ hole punching units developed for punching holes in angles, extrusions, shapes and sheets, emphasizing construction, operation and special features. Includes engineering drawings and specification tables. **Wales Strippit Corp.,** 345 Payne Ave., North Tonawanda, N. Y. **L-8-16**

Aluminum Joining

Recently revised and enlarged 186-page process manual, "Welding Aluminum" containing material on 34 processes suitable for welding, brazing and soldering aluminum and its alloys; large chart shows these processes, their relation to each other, and indicates those most widely used. Numerous other charts and tables, as well as many drawings, graphs and photos give extensive, and detailed information on all phases of the subject. Request only by letter directly to the company, **Reynolds Metals Co.,** 2500 So. Third St., Louisville, Ky.

Blast Cleaning

Comprehensive 28-page brochure 100A, "Blast Cleaning Hose Machines," describes use of hand-operated nozzle blast cleaning equipment; discusses direct pressure and suction methods of applying abrasive, as well as describing applications of wet and soft abrasives. Tables show relationship between orifice area and circumference in nozzle sizes and air flow with required hp to develop air jets of varying diameters; also show how to match nozzle size to size of abrasive used. Gives information to aid in proper selection of equipment for given job. **Pangborn Corp.,** Hagerstown, Md. **L-8-17**

Castings

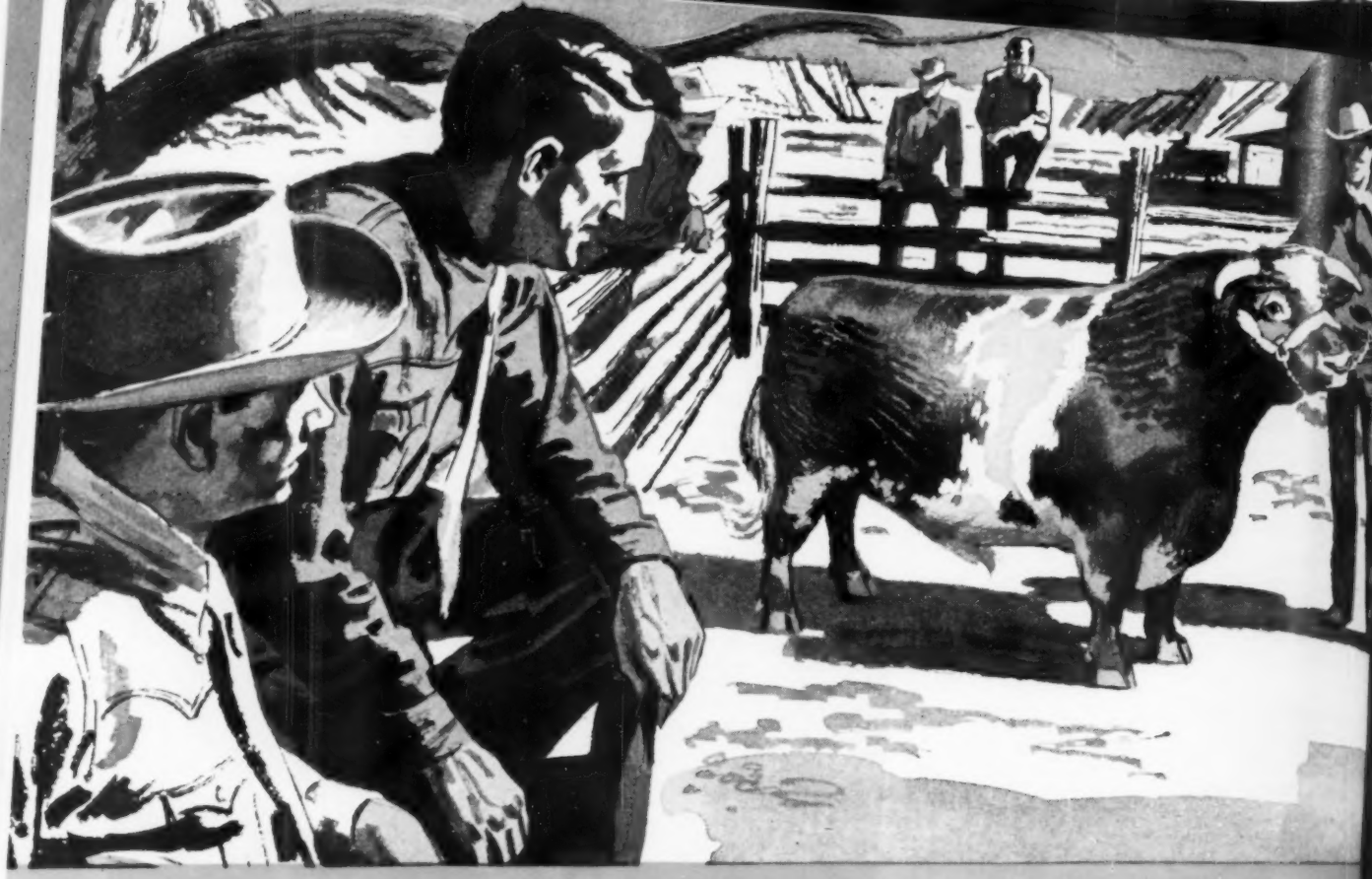
Thousands of standard castings in iron, semi-steel and nonferrous metal listed in catalog which is detailed enough to permit engineers or production men to order directly from information contained therein. Emphasizes standardization to industry provided from such a system setup, and the speed with which such stock can be delivered. **Myerstown Foundry & Machine Works,** Box 296, Myerstown, Pa. **L-8-18**

Motor-Generators

Fifty-page illustrated brochure 51R-7933, "Allis-Chalmers Motor and Generator Reference Book," presents extensive information on the proper selection of motive power for specific industrial applications. Offers information on general, induction and synchronous motors, and general, d-c and a-c generators; covers construction principles, operation and comparisons between types. Material is reprinted from 1952 edition of Lincoln Industrial-Commercial Electrical Reference for which Allis-Chalmers furnished text and illustrations for various points. (Entire 1768-page volume may be purchased from the publisher, Electrical Modernization Bureau, Inc.) **Allis-Chalmers Mfg. Co.,** General Machinery Div., Milwaukee 1. **L-8-19**

Immersion Heaters

Application data for calculating power requirements for heating processing tanks featured in folder which illustrates and describes two of company's line of electric immersion heaters—it's heavy duty steel-sheathed type for heating non-corrosive liquids, and its acid tank heater. **Cleveland Process Co.,** 7016 Euclid Ave., Cleveland 3. **L-8-20**



SMART RANCHERS demand a pedigree!

SMART HOB BUYERS DEMAND A *CERTIFIED* UNGROUND HOB!

The TOOLGRAPH* Chart which accompanies every Illinois Tool Works CERTIFIED Unground Hob is an electrically produced "certificate" of accuracy that shows the exact alignment of each hob tooth in relation to the other teeth. It's a positive, *visual* inspection record, not subject to human error and it's a useful record, too, that helps assure efficient production.

Yes, the TOOLGRAPH Chart is actually a CERTIFIED Unground Hob's pedigree, proof of real value. It's typical of the many *plus* values that design ingenuity, metallurgy, production skill and experience add to *every* Illinois Tool Works cutting tool.

Smart hob buyers, like smart ranchers, demand a pedigree. That's why they specify Illinois Tool Works CERTIFIED Unground Hobs!

ILLINOIS

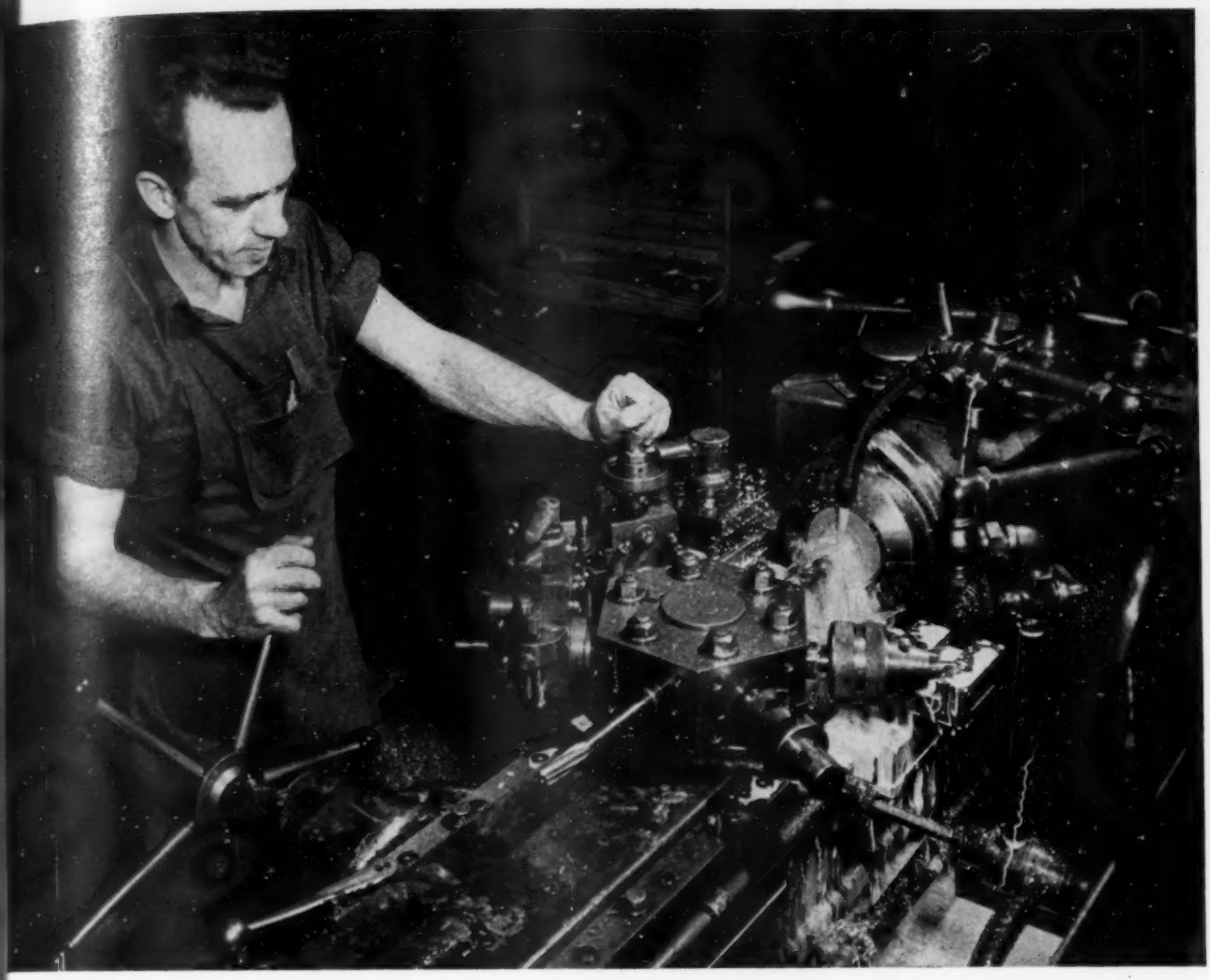
TOOL WORKS

2501 N. Keeler Ave. • Chicago 39, Illinois

In Canada:
Canada Illinois Tools Ltd., Toronto, Ontario

*T.M. Reg. U.S. Pat. Off.

"Headquarters for Engineered Cutting Tools"

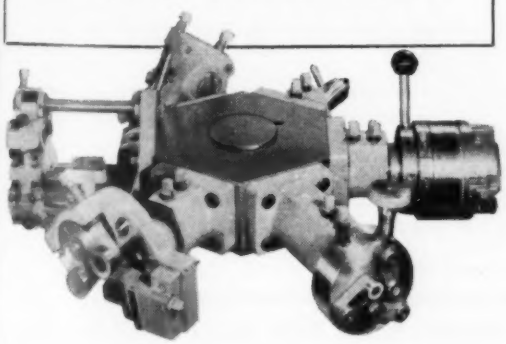


PICTURE OF A MAN PRODUCING 25% MORE

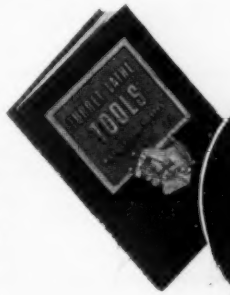
Same job, same operation, but Better Tools!

● This shop has found it can do more jobs faster on Warner & Swasey Turret Lathes with the Standard Tooling Setups that fit their requirements. Multiple and combined cuts, with shorter setup time, mean profitable production increases.

ELECTROL INCORPORATED, of Kingston, New York, transferred this precision Stop-Plunger job to a Warner & Swasey No. 3 Universal Turret Lathe because it had the speed and accuracy required, as well as the proper tooling for the job. The result was a 25% increase in production of this high pressure hydraulic control part.



Permanent Universal Tooling setups and the right tools which can help you increase your output are all in the new 204 page Warner & Swasey Tool Catalog. Write for your copy.



WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

R AND L TURNING TOOL

prized POSSESSION

14 TOOLS IN 1

Machinists treasure quality tools! That's why they have created a constant demand for the precision-made R and L Turning Tool.

Besides changing from right to left in ten seconds, the R and L Turning Tool replaces an assortment of fourteen separate tools. It can be used for rough as well as finished cuts, meeting the most difficult job requirements.

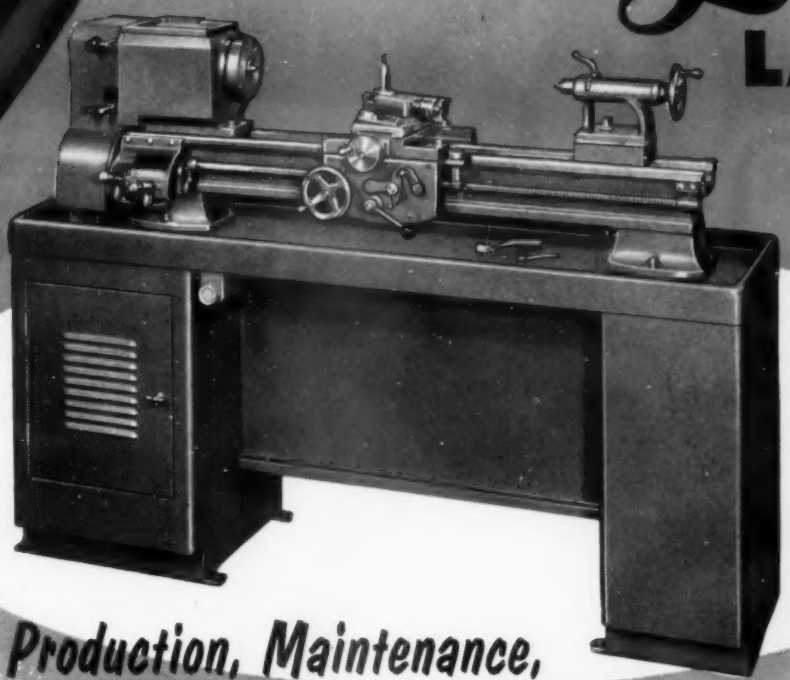
the tools a particular machinist would design for himself . . .

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • TAP AND DIE HOLDER • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL
KNURLING TOOL • CARBIDE AND ROLLER BACKRESTS • RELEASING ACORN DIE HOLDER • REVOLVING STOCK STOP • FLOATING DRILL HOLDER

Presenting THE 12" SWING.. Logan LATHE



For Production, Maintenance, Tool Room or Shop Work

IT'S BIG...

With 12" swing over bed and saddle wings, 1" collet capacity, 1⅛" spindle hole, and 35" center distances this newest Logan has the size to handle a major share of the average shop's lathe work.

IT'S RUGGED...

Its heavy headstock, massive spindle and rugged construction throughout make the 12" swing Logan a lathe of precision, stability and power.

IT'S VERSATILE...

Smoothly, without chatter, the 12" swing Logan Lathe hogs out amazingly heavy cuts. It is equally effective in high speed production and second operation work. Sustained accuracy at all spindle speeds (38 to 1260 rpm) is inherent in the ball bearing spindle mounting. This fact plus features like extra large compound and cross feed dials adapt it to exacting tool room operations. Its durable construction and enclosed design are important advantages in the school shop.

IT'S ACCURATE...

The wide-spaced, oversize ball bearing spindle mounting means *sustained* accuracy. Total spindle run-out, 12" out from the bearing is less than .0005". The 6 15/16" wide bed is heavily ribbed for rigidity. 2 V-ways and 2 flat ways precision ground to within .0005". Extra large dials on the new carriage permit accurate readings. Precision built throughout.

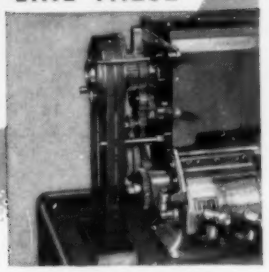
IT'S SIMPLE TO OPERATE...

No spindle adjustment is required for any speed from 38 to 1260 rpm. Dials are easy to read. All controls and levers are easily accessible. Outboard drive simplifies belt adjustment and change. Inexperienced operators and students quickly master this rugged, accurate lathe.

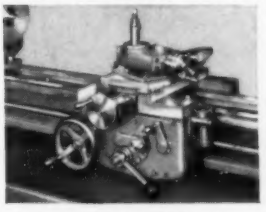
IT'S ECONOMICAL...

By the multiple economies it offers—investment, maintenance, space and power—the 12" Logan brings new economy and new profits to every type of lathe operation.

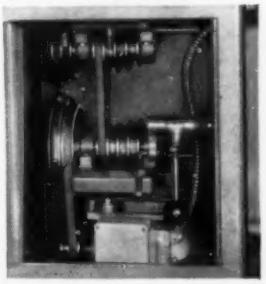
With FEATURES LIKE THESE



OUTBOARD V-BELT DRIVE
Double V-Belts transmit power to headstock with maximum efficiency and are easily accessible for change or adjustment.



NEWEST, FINEST CARRIAGE
Convenient, rigid, accurate, completely machined. Accurately machined and ground top surfaces on cross slide and saddle permit mounting fixtures and use of magnetic indicators. Apron operates in bath of oil. Simple, convenient, lever-operated disc type clutch.



UNDERNEATH V-BELT DRIVE
Jack-shaft and countershaft turn on ball bearing mounting. Motor and all parts are completely enclosed, yet easily accessible. Lever operated belt tension releass.

SEE THIS NEW LATHE AT YOUR LOGAN LATHE DEALER'S, OR

Write for Information...

Full catalog descriptions and price information on request. ***Write today to***

LOGAN ENGINEERING CO.
Lawrence and Lamon Avenues
Chicago 30, Illinois

LOOK TO LOGAN FOR BETTER LATHES AND SHAPERS

New Buy-word for Top Value

SHOLD-A

FROM STOCK!

Correct Taper

Typical design (above) of SHOLD-A-GRIP Bushing and Sprocket with minimum number of teeth.
Typical design (below) of SHOLD-A-GRIP Bushing and Sprocket with maximum number of teeth.

FIT SHAFTS
½" to 2½" by 16ths

SHOLD-A-GRIP Sprockets of any commonly used pitch, ½" to 1¼", can be interchanged on an extended range of shaft sizes. SHOLD-A-GRIP design adds many smaller sprocket sizes to the interchangeable class.

Example: Sprocket BKSD, ¾" pitch, 10 teeth, can be used on 9 different shaft sizes, any size from ½" to 1" by 16ths, by inserting the correct size SHOLD-A-GRIP Bushing.

Engineered *originally* and *specifically* for Sprocket drives, SHOLD-A-GRIP Bushings are *not* an "adapted" design. Compare . . . see why SHOLD-A-GRIP means top efficiency, lowest maintenance costs.

GEARS • CHAIN and SPROCKETS • RATIOMOTORS • REDUCTORS • BOST-BRONZ Oil-Impregnated BEARINGS • PILLOW BLOCKS

Sprocket Assemblies . . . ask for

D-A-GRIP®

Interchangeable Tapered BUSHINGS and SPROCKETS

You'll be Sure to get . . .

Correct Taper

FOR SLIP-PROOF GRIP

In SHOLD-A-GRIP Bushings and Sprockets, you get a taper proved by exhaustive overload tests to be the optimum for slip-proof grip. When screws are tightened the bushing grips both sprocket and shaft with maximum holding power, even on shafts which vary from true diameter.

Correct Taper

FOR EASY REMOVAL

Correct taper saves time and trouble in removal. Cap screws are removed, then two screws are turned into the two threaded holes in bushing flange. Tightening screws releases bushing—quickly, easily.

Matched Tapers

AVOID "ROCKING" FIT

All Bushing and Sprocket tapers are machined with integrated and matched tooling, to avoid possible variation from random production. There is no risk of a "rocking" fit. SHOLD-A-GRIP gives you fast, free interchangeability, over the entire size range.

High-strength Design

BY BOSTON Gear EXPERTS

Because of the unique, patented SHOLD-A-GRIP construction, holes for screws are in the shoulder. There are no weakening holes in the sprocket itself. BOSTON Gear quality throughout assures longer service life on your toughest drives.

Completely engineered and manufactured by BOSTON Gear . . . for 75 years the leading specialists in Stock Gear and Sprocket design.

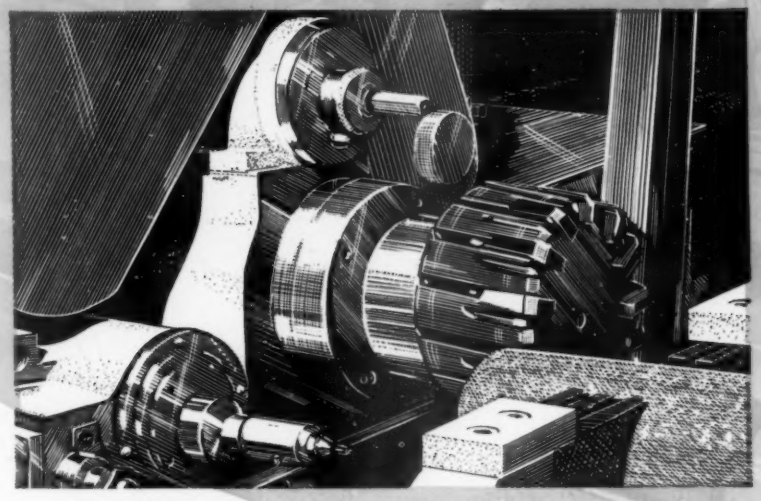
Complete information on SHOLD-A-GRIP Bushings and Sprockets is available from your Boston Gear Distributor, or write Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

ASK YOUR NEARBY

BOSTON Gear® DISTRIBUTOR

UNIVERSAL JOINTS • COUPLINGS • BALL BEARINGS • OVER 5000 STOCK ITEMS

OK end mills rough-mill forged steel propeller shaft ends for world's most powerful piston aircraft engine



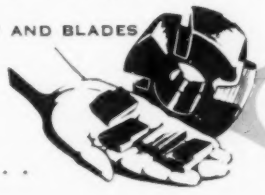
TWO OK END MILLS, ON A SUNDSTRAND COMBINATION CUT OFF AND CENTERING MACHINE, ROUGH-MILL THE ENDS OF TOUGH STEEL PROP SHAFT FORGING FOR A PRATT & WHITNEY AIRCRAFT WASP MAJOR PISTON ENGINE

IN the building of this mighty engine, there are hundreds of milling operations that must be done to dimensional tolerances unknown in other industries. Meeting these close tolerances is no difficulty when your machines are in top condition and you use OK milling cutters. OK cutters are popular because of their powerful bodies, and simple, streamline designs. Size for size, they have more beef in the body, more metal backing each blade. No metal is cut out to make room for locks, blocks, screws, gibs, or other blade holding devices. Blades once set, stay secure without tipping or slipping. More blades are carried for finishing cuts, and heavier blades for roughing cuts.

Write for OK Tool Catalogs

"MODERN MILLING CUTTERS FOR MODERN MILLING MACHINES"
"AMERICA'S FIRST SYSTEM OF SINGLE POINT TOOLS"

TWO COMPONENTS—BODY AND BLADES
SIMPLE . . .
STRONG . . .
SUFFICIENT . . .



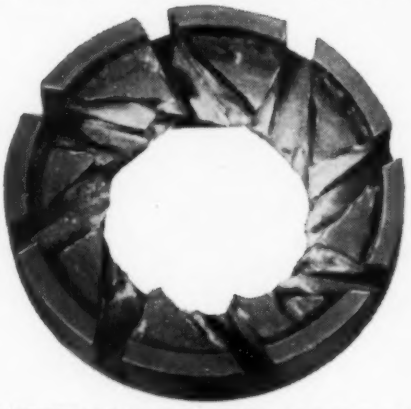
OK

modern milling cutters for modern milling machines

THE OK TOOL COMPANY Milford, New Hampshire

This HAYNES STELLITE alloy part *lasted 12 times as long as* this alloy steel part

AFTER 1 YEAR'S SERVICE



AFTER 30 DAYS' SERVICE

Micronizer nozzle disks, machined from alloy steel, wore out in just 30 days when used for converting gas house tar into an ignited vapor in a steam generator unit. The abrasive particles in the fuel and the high velocity (39,000 ft. per min.) of the steam rapidly eroded the alloy steel parts to destruction. This same limited service was obtained from disks used in precipitating dust from the exhaust uptake of air-swept coal pulverizers in a power plant.

After considerable testing, investment-cast parts of HAYNES STELLITE alloy No. 19 were adopted as standard equipment. This hard cobalt-base alloy stands up for at least a year under the severe abrasion—outwears the alloy steel 12 to 1. The parts are produced so accurately by the investment casting process that finishing operations are cut to a minimum.

HAYNES precision casting is an ideal manufacturing method for parts that must be made from an alloy difficult to fabricate into intricate shapes by ordinary methods. For more information, write for the booklet, "Investment Castings."

HAYNES TRADE-MARK *alloys*

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Sales Offices
Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

"Haynes" and "Haynes Stellite" are trade-marks of Union Carbide and Carbon Corporation.

Red Shield says:

"STANDARD for tough jobs since 1881"

as near as your telephone

Call your Industrial Supply Distributor for Shield Brand End Mills. Specialized factory service available everywhere.

STANDARD TOOL CO.

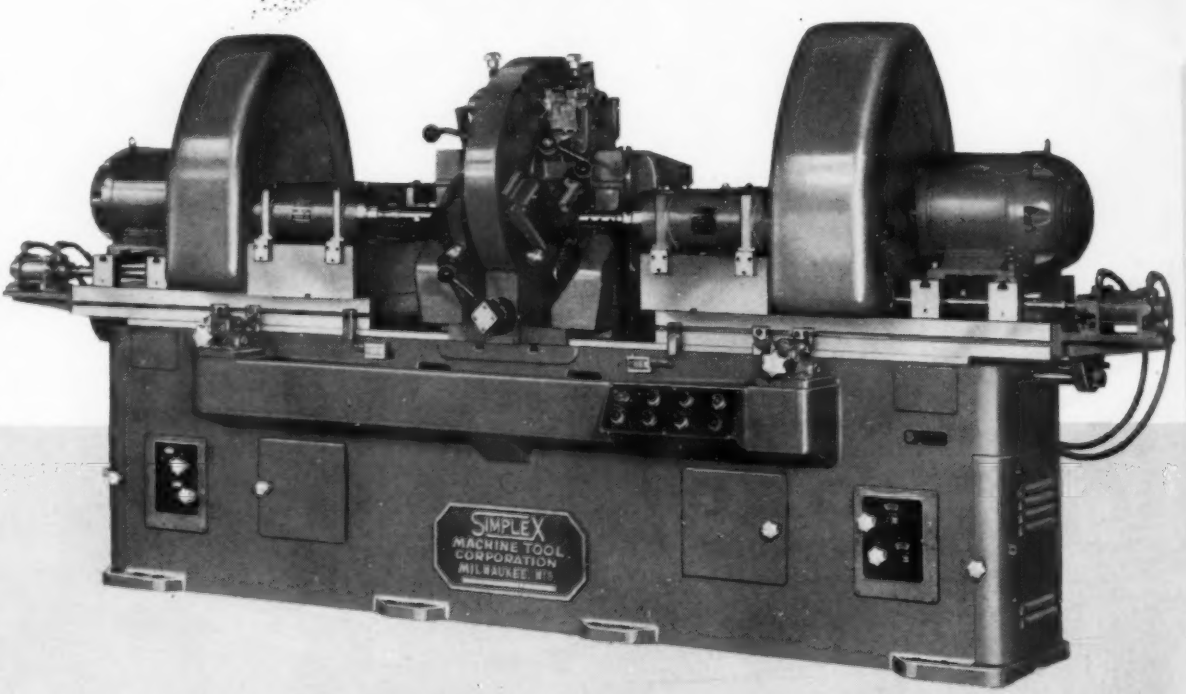
3950 CHESTER AVENUE CLEVELAND 14, OHIO

NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

High Production! Simplex Precision!

Maximum production requires multiple tools and a cutting cycle with a minimum of idle time.



A prominent Outboard Motor Manufacturer found his answer in this SIMPLEX double end, four spindle, Precision Boring Machine. A three station double end trunnion indexing fixture allows free loading time and two blocks or four cylinders are finish bored with each machine cycle. Can you apply this principle to your job?

Simplex **PRECISION BORING MACHINES**

SIMPLEX MACHINE TOOL CORPORATION

FORMERLY STOKERUNIT CORPORATION

4528 WEST MITCHELL STREET

MILWAUKEE 46, WISCONSIN

PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES • SPECIAL MACHINE TOOLS

THE STANDARD LINE: *Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

Vanadium-Alloys

brand names *

that deliver

Distinctive Performance

on your **cold work** die jobs!

Non-Shrinkable Colonial No. 6 Non-Deforming, Oil Hardening Die Steel having excellent machining properties; low hardening temperature. Popularly used for blanking punches and dies, gauges, bushings, and miscellaneous tools.

Air Hard 5% Chromium Steel with minimum distortion in air hardening. Especially adapted for better wear and toughness in thread rolling dies, form and blanking dies, punches, knurls, gauges.

Ohio Die Air Hardening, High Carbon-High Chromium Steel. Free from movement in hardening, combines high wear resistance and toughness for difficult jobs. Your choice on trimming dies, shear blades, coining dies, rolls and mandrels.

Crocar High Carbon-High Chromium Die Steel with outstanding resistance to wear. Can be either air or oil hardened. Select this grade for lamination dies, wear plates, slitting cutters, and forming dies.

Red Star Tungsten An unusual Oil Hardening Die Steel. Maintains keen cutting edges; excellent for punches, taps, blanking dies, spinning tools, and slitters.

It pays to *buy by brand*——when the brand-name speaks for *extra performance on the job.* As makers of First Quality tool steels exclusively, we say: buy Vanadium-Alloys' steels by name—and get the values added to each composition by our *specialized process of manufacture* . . . values that are physical, measurable, and profit-making for you!

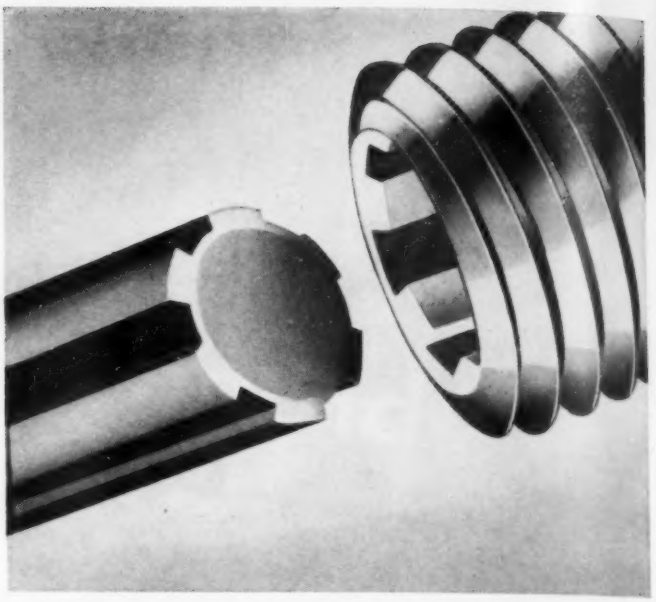
Vanadium-Alloys
STEEL COMPANY
LATROBE, PENNA.

Colonial Steel Division — Anchor Drawn Steel Co.

BRISTOL'S
Multiple-Spline
SOCKET SCREWS

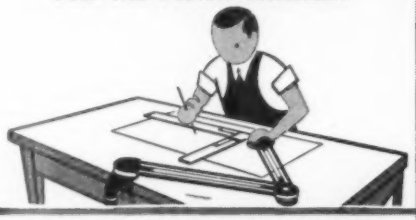
Stronger by far than any other kind!

The splining principle is recognized by design engineers as the best means of transmitting rotary power—that's why it's used in propeller hubs, in drive shafts and rear axles of automobiles. In Bristol's Multiple-Spline socket screws, this design results in strength and holding power not equalled by any other screw.



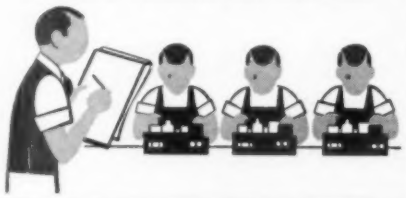
LOOK AT THE THINGS THEY DO . . .

FOR THE DESIGN ENGINEER



- ✔ Tremendous holding power
- ✔ Withstand severe shock and vibration
- ✔ Permit neater, more compact design—fit flush, no projecting head

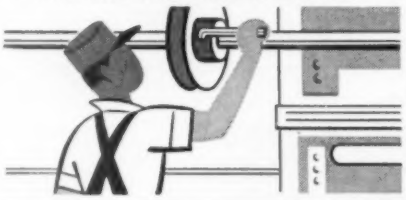
FOR THE PRODUCTION ENGINEER



all the above, *plus* . . .

- ✔ Greater holding power, permitting use of fewer, smaller screws.
- ✔ Will not round out, split or break
- ✔ Speed assembly—can be set tighter, easier, faster
- ✔ Minimize rejects and marring

FOR THE MAINTENANCE MAN



all the above, *plus* . . .

- ✔ Can be tightened and loosened indefinitely
- ✔ Maintain desired set—won't shake loose
- ✔ Easily wrenched in hard-to-get-at places
- ✔ Tamper-proof

Multiple-Spline Set Screw

Multiple-Spline Cap Screw

Bristol's Multiple-Spline Cap or Set screws are carefully designed to close tolerances (A.S.A. approved, Class 3 fit). Precision-threaded National Coarse or National Fine.

Materials: Standard and listed sizes stocked in heat-treated alloy steel. Brass, bronze, monel, stainless steel, etc., on special order.

Sizes: 0 wire to ½ in. in diameter.

FOR 30 YEARS A BRISTOL EXCLUSIVE!

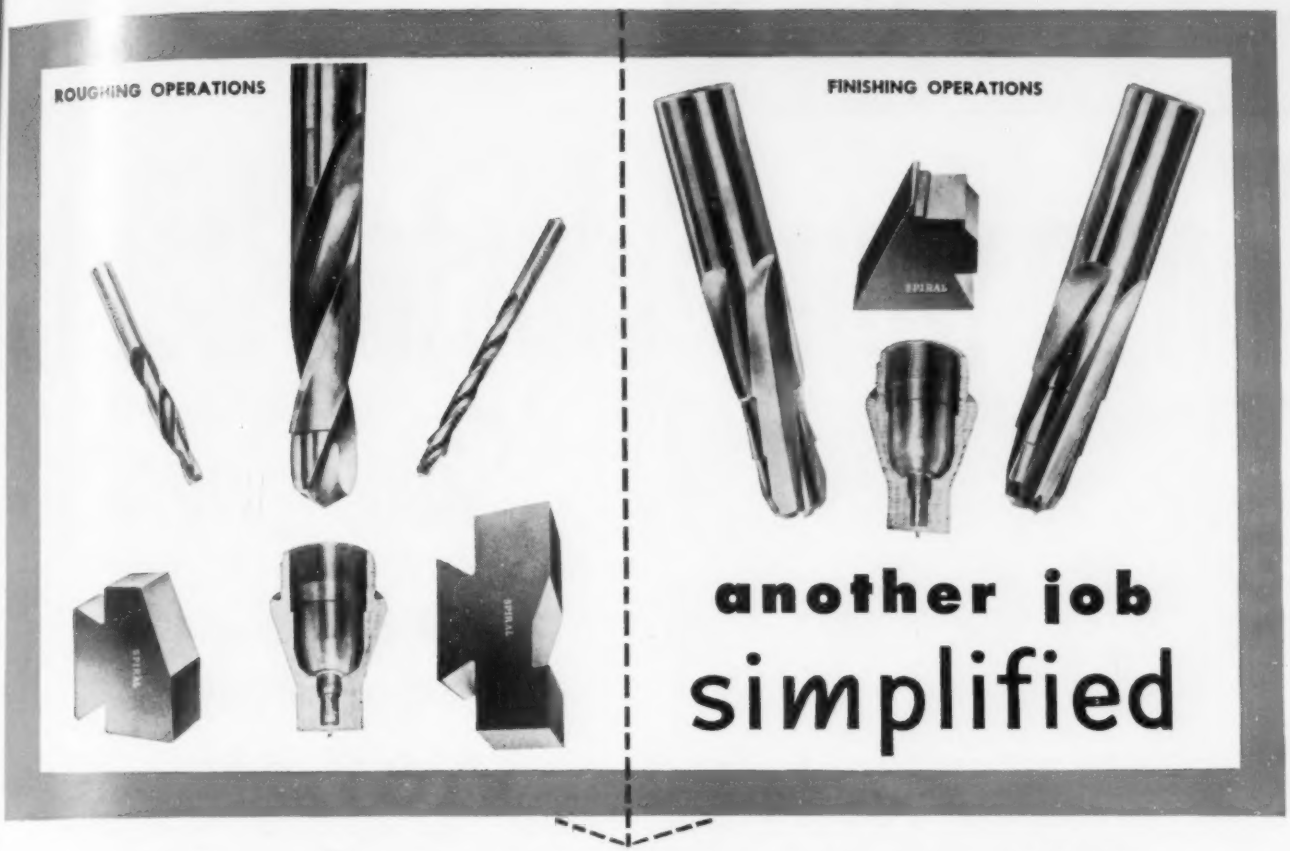
Write for free bulletins showing applications. Only Bristol makes *both* Multiple-Spline and Hex . . . for severe and regular service.

BRISTOL'S SOCKET SCREWS

Multiple-Spline and Hex Socket Screws. Cap and Set

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Connecticut

A.3.1



at a lower piece cost with

SPIRAL

special cutting tools

HIGH SPEED OR CARBIDE

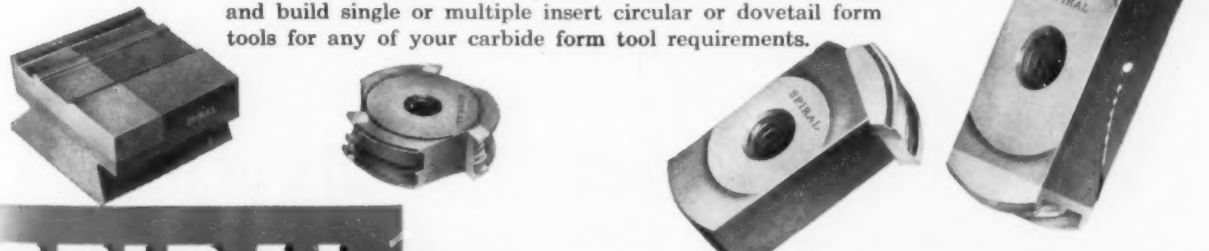
Tough cutting problems are simplified with Spiral special tools. The solution illustrated here is another example of how Spiral provides maximum tolerance control and longer tool life, while increasing production, with special tools fitted to the job.

FREE TOOL ENGINEERING HELP

For a quick answer to your specific cutting tool problems, send complete details, including tool, part print and specifications. Write for a free copy of latest bulletin showing other examples of SPIRAL time saving tools.

CARBIDE FORM TOOLS

Working from your tool or part prints, SPIRAL will design and build single or multiple insert circular or dovetail form tools for any of your carbide form tool requirements.

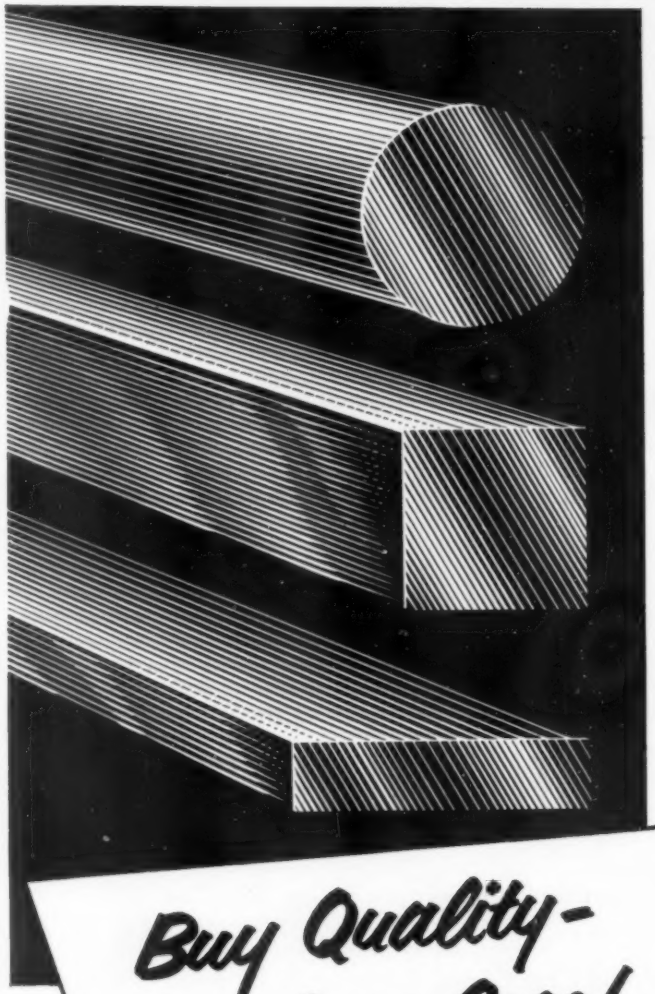


SPIRAL STEP TOOL COMPANY

5400 NORTH DAMEN AVENUE • CHICAGO 25, ILLINOIS

Dept. TE • PHONE: LOngbeach 1-5384

Made from Selected Heats



"Sure-Spec"

DRILL ROD
TOOL STEEL
ALLOY BARS

These quality Sure Spec cold finished bar steels provide—

1. Increased tensile strength
2. Increased yield strength
3. Increased tortional strength
4. Increased hardness
5. Resistance to wear
6. Decreased ductility
7. Excellent machinability
8. Smooth, bright finishes

Buy Quality-
Buy Sure-Spec!

Need a safe, sturdy steel storage cabinet for your bar stock? Write for details on our low priced locked cabinet or floor rack, each holds 20 different sizes.

"for service dependable as the sun"

SOLAR STEEL CORPORATION

SURE® SPEC

General Offices: UNION COMMERCE BUILDING, CLEVELAND, OHIO

See your local classified telephone directory for our nearest office address

SALES OFFICES: Bridgeport • Chicago • Cincinnati • Cleveland • Detroit • Grand Rapids • Kalamazoo • Milwaukee • Nashville
Philadelphia • River Rouge, Mich. • Rochester, N. Y. • Toledo • Union, N. J. • Washington, D. C. • Worcester, Mass.

TOOL STEEL THAT MACHINES

TOOL STEEL THAT MACHINES 30% FASTER NOW AVAILABLE IN HOLLOW BAR FORM

ADVANTAGES OF GRAPH-MO

MOST STABLE TOOL STEEL MADE
OUTWEARS OTHERS 3 TO 1
MACHINES 30% FASTER
MINIMUM TENDENCY TO PICK UP, SCUFF OR GALL
UNIFORM RESPONSE TO HEAT TREATMENT

PLUS

ADVANTAGES OF HOLLOW BARS

NO DRILLING
FINISH BORING IS FIRST STEP
LESS MACHINING TIME
LESS SCRAP LOSS
MORE PARTS PER TON OF STEEL

EQUALS

ADVANTAGES OF

GRAPH-MO HOLLOW-BAR

NEW GRAPH-MO® HOLLOW-BAR COMBINES THE FASTER MACHINING AND LONGER WEAR OF GRAPH-MO WITH THE ECONOMY OF A HOLLOW BAR SECTION

Now manufacturers of ring-shaped tool steel parts can get all the proven advantages of Graph-Mo® steel *plus* the economies of a hollow bar section in Graph-Mo Hollow-Bar—a new graphitic tool steel product in hollow bar form developed by the Timken Company.

The center hole's already in Graph-Mo Hollow-Bar. Drilling is eliminated. You save machining time, cut scrap loss, get more parts per ton of steel.

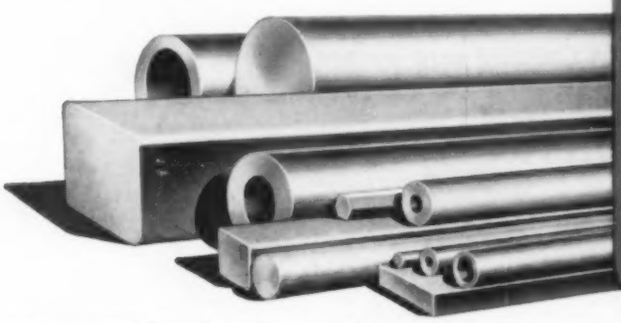
Graph-Mo is a different kind of tool steel. Free graphite in its structure makes it 30% easier to machine! And the combination of free graphite and diamond-hard carbides gives it unusual wear-resistance. Users report it outwears other tool steels an average of 3 to 1!

Stability tests prove Graph-Mo is the most stable tool steel ever made. After 12 years, a typical Graph-Mo steel master plug gage showed less than 10 millionths of an inch dimensional change! It responds uniformly to heat treatment, has a minimum tendency to pick up, scuff, seize or gall.

If you make ring gages, dies or other ring-shaped tool steel parts, make sure you're getting *all* the advantages of Graph-Mo Hollow-Bar. Sizes range up to 16" O.D. with a variety of wall thicknesses. Graph-Mo Hollow-Bar is distributed through A. Milne and Co. and Peninsular Steel Co. warehouses.

For more information about Graph-Mo Hollow-Bar, write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH



TIMKEN
Fine Alloy
STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

"YES...WE'VE GOT THOSE TAPS IN STOCK"

That's your INDUSTRIAL DISTRIBUTOR talking. Many a time, no doubt, you've heaved a sigh of relief when you've heard the welcome words, "Sure we've got 'em", or when you need service, "We'll send Jack right over".

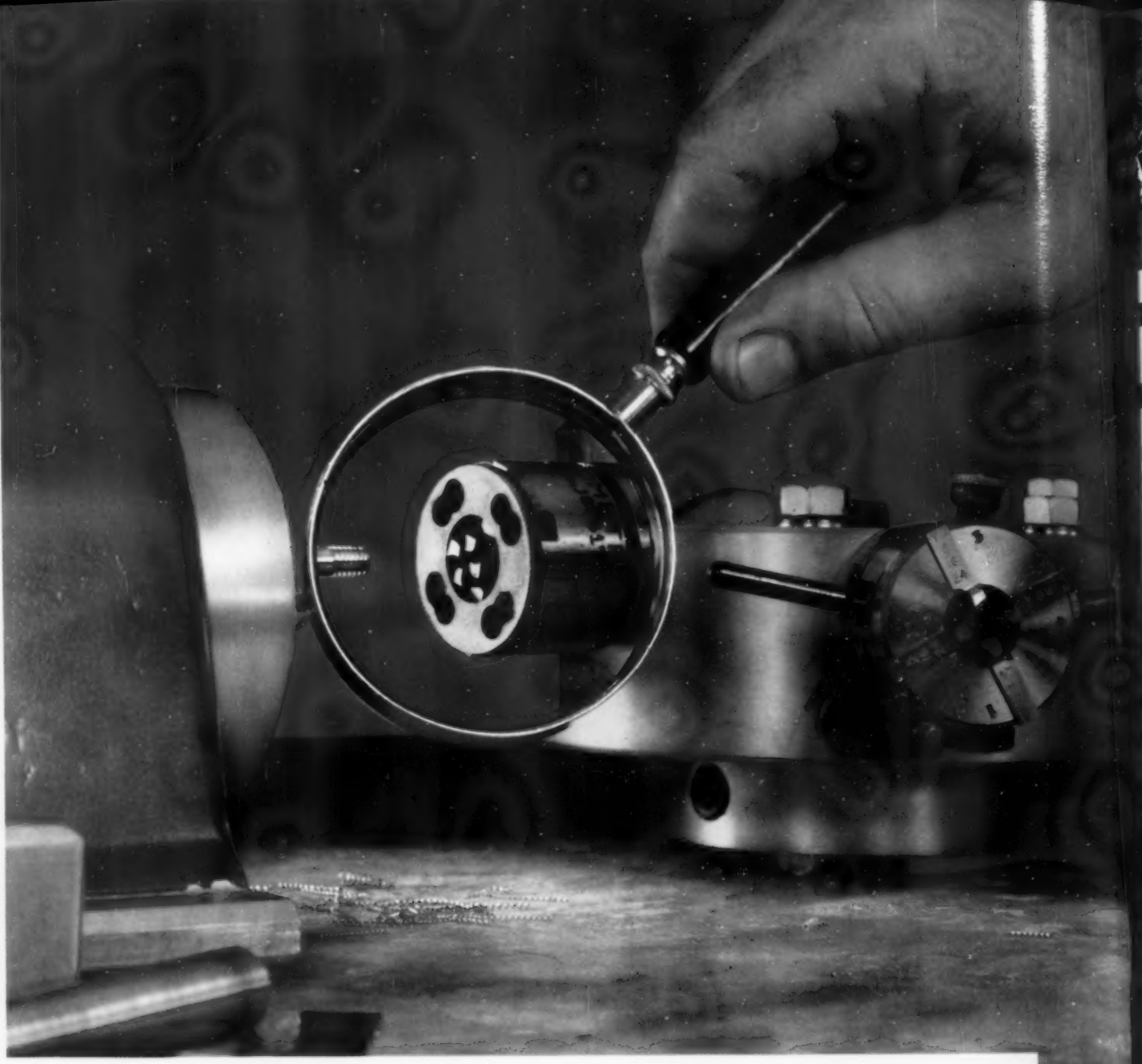
And your GTD-GREENFIELD Distributor also has direct friendly contact at the factory with men he knows well, regarding non-stocked items or special tools.

Yes, it will pay you to get better acquainted with your GTD-GREENFIELD Distributor. Stop shopping around . . . stop buying the hard way.

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS.

Tool Steel Topics



A MIDGET IN SIZE . . A GIANT FOR WORK!

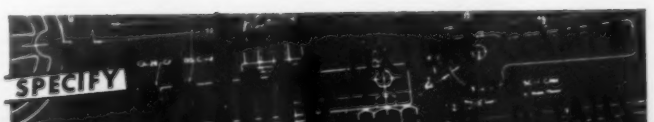
This tiny Solid Adjustable GEOMETRIC Die Head, with ground thread chasers, was designed for fast, accurate cutting of Class 3 fits — diameters #0 to #10 Machine Screw and 1/16" to 3/16" in pitches 24 and finer. Called the EJ5, this die head is only 1" in diameter . . . weighs less than four ounces complete with chasers. There are models to fit each type and size of machine commonly used for all sorts of small diameter precision threading and widely used for such products as instruments, cameras and business machines.

Write for full details. Specify Bulletin EJ5

Greenfield Tap and Die Corporation

GEOMETRIC TOOL COMPANY DIVISION

NEW HAVEN 15, CONNECTICUT



ELIMINATE HUMAN ERRORS WITH INDICATING

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export: Bethlehem Steel Export Corporation

Three types of tool steel solve most hot-work problems

Hot-work tool steels which contain large amounts of either tungsten or molybdenum have high "red-hardness." In other words, they withstand very high operating temperatures without softening.

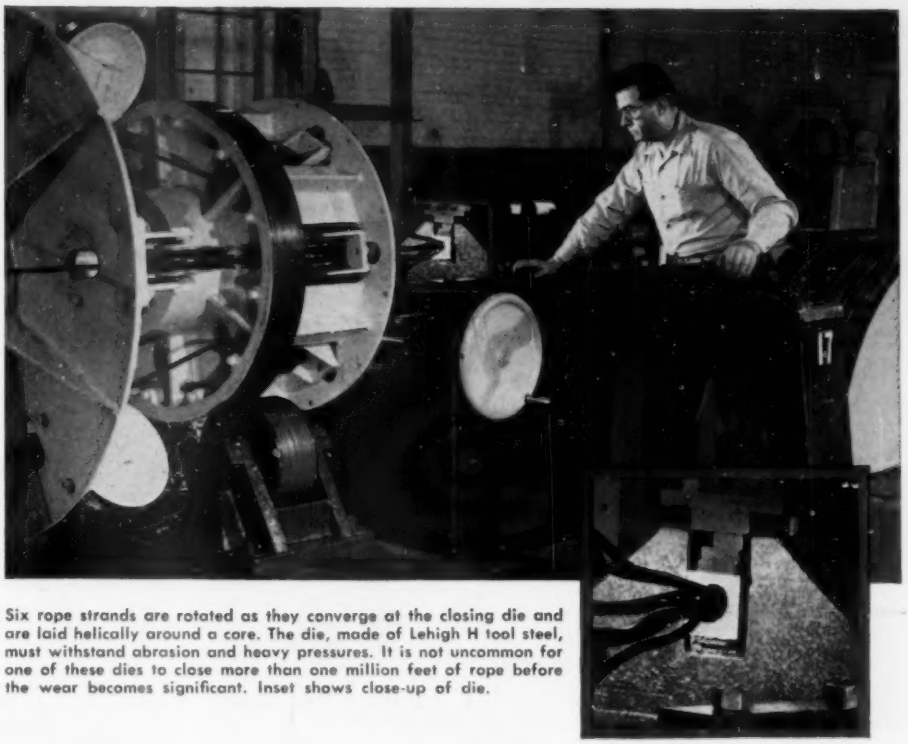
Although these steels have excellent wear-resistance, they cannot be subjected to drastic water-cooling while in operation because this results in excessive "heat-checking." Caused by repeated thermal stress, this condition shortens their service life. The 8½-pct-molybdenum type (our Hot-Work 8) is better in this respect than the 9-pct-tungsten type (our 57 Hot-Work).

One way to prevent excessive temperature build-up, in repetitive operations where water-cooling is not used, is to provide duplicate tools which can be used alternately in the operation. This arrangement makes possible a longer cooling time between operations than if only one tool is used.

Whenever the nature of the hot-work operation is such that water-cooling of the tool is practical, it is often best to use one of the 5-pct-chromium types of hot-work steel—such as our chrome-moly-tungsten (Cr-Mo-W) and chrome-moly-vanadium (Cr-Mo-V) grades. The cooling prevents loss of hardness due to high temperature.

Although they have lower red-hardness, the 5-pct-chromium grades are good choices for tools and dies which involve both shock and hot-metal contact.

Operated in a 400-ton press, this punch is made of Bethlehem Cr-Mo-W tool steel. It extrudes steel slugs heated to 1950 F in the making of rock bits.



Six rope strands are rotated as they converge at the closing die and are laid helically around a core. The die, made of Lehigh H tool steel, must withstand abrasion and heavy pressures. It is not uncommon for one of these dies to close more than one million feet of rope before the wear becomes significant. Inset shows close-up of die.

Wire rope "closed" by long-wearing dies of LEHIGH H tool steel

One of the vital steps in the making of wire rope is the "closing" operation which arranges the rope strands compactly in a helical position around a core of either hemp or steel wire.

Closing dies are subject to considerable abrasion by the rotating strands as they converge at the die and pass through, at the same time being laid into accurate position. Lehigh H is ideal for this application because its high-carbon, high-chromium composition gives it extreme long-wearing properties. When the dies eventually become worn, they are usually refinished for use in closing rope of a larger diameter.

Made in two pieces, closing dies are machined to accurate size, heat-treated to a hardness of about Rockwell C-61; then they are ground and polished to avoid damage to the wearing surfaces.

Because of its air-hardening characteristics, Lehigh H is subject to only the minimum amount of distortion during heat-treatment—an important feature wherever accuracy is essential.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Avoid sharp-cornered keyways

Keyways with sharp corners are the cause of many shaft failures. Fundamentally, this type of breakage is a fatigue-failure due to excessive stress-concentration at the sharp corners.

The cure for failures of this kind is to make keyways of half-round design and use a round key in the assembly.

Of course, the fact that stresses are low often prevents the failure of shafts with square keyways; and so this design continues to be used. But that does not alter the fact that a square keyway on a shaft is a basic design fault.

WHEN
IT
COMES
TO
PRODUCTION . . .

COME TO

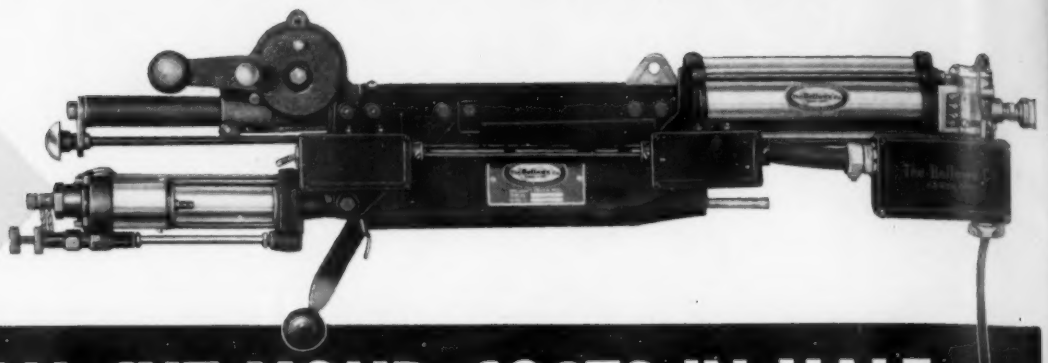
HARTFORD
Special

AUTOMATIC DRILLING & TAPPING MACHINES

THE HARTFORD SPECIAL MACHINERY CO. • HARTFORD 12, CONN.

IF YOU DRILL HOLES

this



CAN CUT YOUR COSTS IN HALF...

"This" is the Bellows Drill Press Feed. It goes on the star wheel shaft of any standard drill press. A touch on the operating lever and the Drill Press Feed advances the drill rapidly to the work, feeds the drill through the work at the correct feed rate, and returns the drill to its starting position. It's so simple in operation that workers with less than an hour's training can produce top quality work at top production rates.

It can be installed on a drill press in less than half an hour. It can be moved from one drill press to another. It doesn't interfere with hand operation of a drill press when desired.

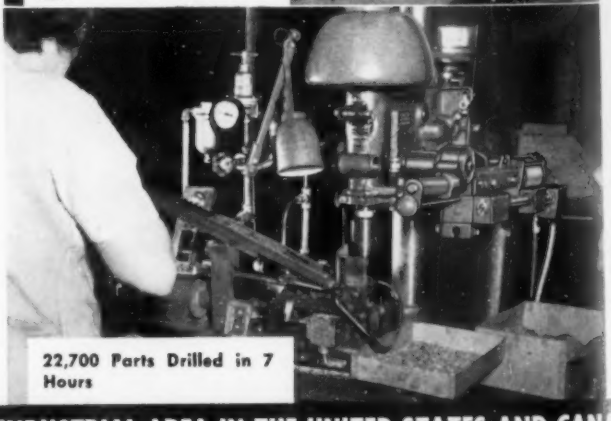
And, if the experiences of thousands of users are any criterion, it will pay for itself in your plant with the first two weeks' cost savings.

If you drill holes — it can cut your costs in half.

The Bellows Drill Press Feed is one of many "packaged" Controlled-Air-Power Devices to convert manually operated equipment to fast, low-cost automatic machines. New Bulletin CL-50 describes them all. Write for it today. No cost. No obligation. Address Dept. TE-853, The Bellows Co., Akron 9, Ohio.

400% Production Gain in this drilling operation

One minute per part by hand, 25 seconds per part now



22,700 Parts Drilled in 7 Hours

The Bellows Co.

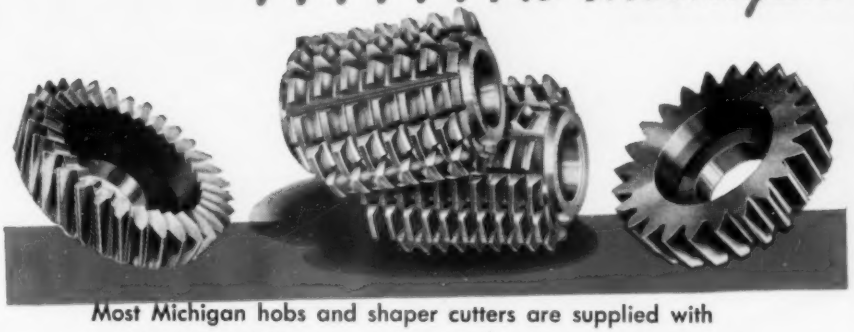
AKRON 9, OHIO

757a

FIELD ENGINEER OFFICES IN EVERY MAJOR CITY AND INDUSTRIAL AREA IN THE UNITED STATES AND CANADA

STANDARD TOOLS ARE CUSTOM ENGINEERED .....

..... At Michigan



Most Michigan hobs and shaper cutters are supplied with modifications which our experience has shown are best suited to the particular applications for which the tools are ordered.

Michigan Tool engineers always design hobs and shaper cutters with every step in the production of the gear in mind. They are thus often able to incorporate modifications in the tools that result in lower gear cost, faster and easier finishing, longer gear life, better tooth form, greater quietness—advantages that mean better gears at lower cost.

Specify *custom engineered* standard gear cutting tools and see the difference for yourself.

GEAR PRODUCTION HEADQUARTERS

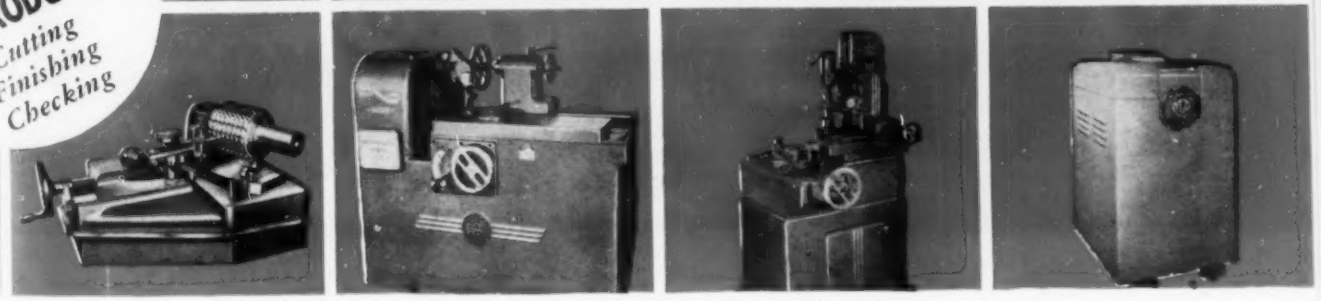
MICHIGAN TOOL Company

from blank to finished gear

7171 E. McNICHOLS RD. • DETROIT 12, MICHIGAN, U. S. A.

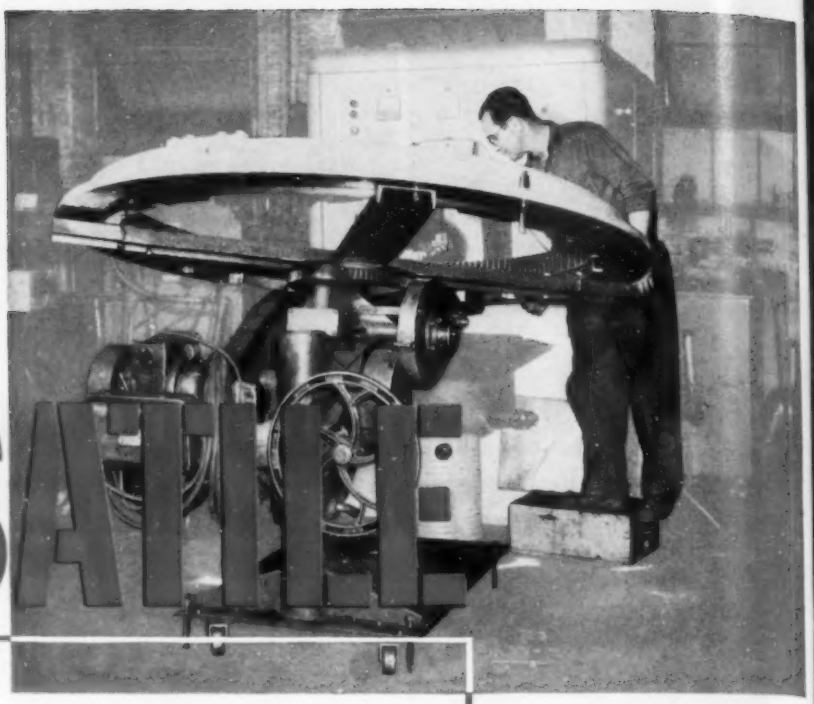
COMPLETE EQUIPMENT for GEAR PRODUCTION

Cutting
Finishing
Checking

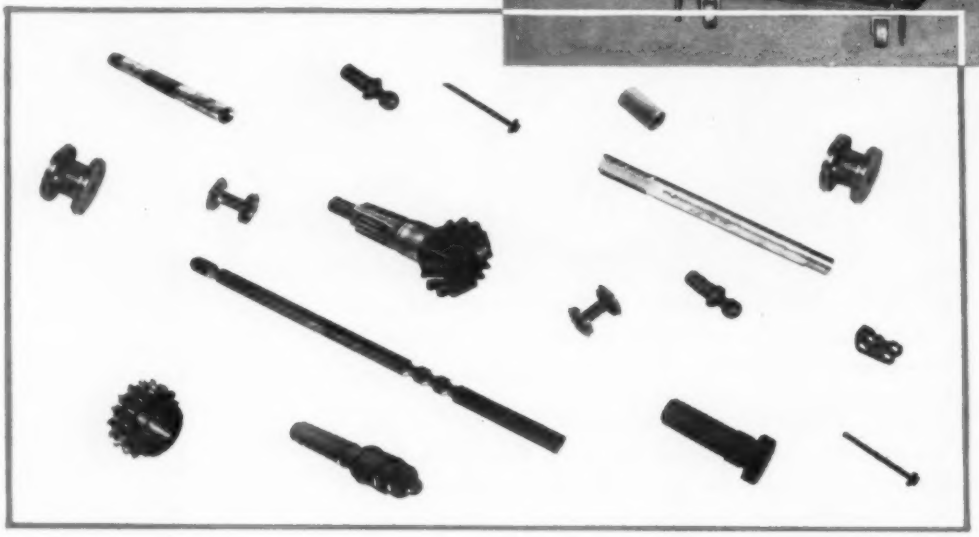


Shown here is only a part of Michigan's complete line

VERSATILE



"Internal ring gear being hardened on the Lindberg LI-25 Induction Heating Unit".



Investigate the amazing versatility of the Lindberg Induction Heating Unit—approximately 2000 different parts have been selectively hardened or annealed on this typical commercial heat treating installation.

FROM THE LARGEST—The internal ring gear illustrated above—with a 60″ inside diameter, 3½″ face with 187 teeth each individually heated and oil spray quenched.

TO THE SMALLEST—This small 2″ stamped metal rocker arm was selectively heated and water quenched on the small square face at the rate of 3000 per hour. Investigate this versatile Lindberg Induction Heating Unit—it may supply the answer to your selective heating operations.

SPECIFY LINDBERG

for any heat treating or melting need! Lindberg manufactures every type and many sizes of melting and heat treating furnaces from tiny laboratory units to mammoth field erected installations—whether it's gas, oil, electric, arc, low or high frequency—consult your local Lindberg Office!

LINDBERG
HIGH FREQUENCY DIVISION

Lindberg Engineering Company, 2447 W. Hubbard Street, Chicago 12, Illinois

Proved in Service...

The SURFINDICATOR *weighs only 15 pounds and can be set up anywhere in the plant where 115 volts a. c. is available. Completely self-contained.*

Manufactured under patent license from General Motors Corporation

NEW... the BRUSH SURFINDICATOR*

a practical shop tool for measuring SURFACE ROUGHNESS

WITH THIS NEW, portable inspection tool you can make surface roughness measurements on the production line. The operator merely guides the pickup over the piece to be inspected and then reads surface roughness in average microinches on the meter.

The SURFINDICATOR is *always reliable* because the unit is equipped with a set of Precision Reference Specimens. These permit checking accuracy of the instrument at any time and provide a set of standards for absolute calibration. Using SURFINDICATORS, several plants in different locations can all produce parts to the same surface roughness specifications. Get the complete story on the SURFINDICATOR now!

*Trade Mark

MAIL COUPON FOR BULLETIN . . . OR ASK YOUR BRUSH REPRESENTATIVE FOR DEMONSTRATION!

1. **HARTFORD, Connecticut**
M. S. Coldwell, 289 Fairfield Ave.
2. **NEW YORK 13, New York**
Burlingame Associates, 103 Lafayette St.
Offices: Asbury Park, N. J., Bogota, N. J., Philadelphia, Pa., Syracuse, N. Y., Upper Darby, Pa.
3. **CLEVELAND 15, Ohio**
M. P. Odell Co., 2536 Euclid Ave.
4. **WASHINGTON 9, D. C.**
Brush Electronics Co., 1609 Connecticut Ave., N. W.
5. **DETROIT 14, Michigan**
Anthony R. Satullo, 7635 E. Jefferson Ave.
6. **INDIANAPOLIS 20, Indiana**
Armin Leich, 5860 Norwaldo Ave.
7. **ALEXANDRIA, Virginia**
W. A. Brown & Associates, 3834 Mt. Vernon Ave.
Offices: Atlanta, Ga., Birmingham, Ala., Charlotte, N. C., Tampa, Fla.
8. **CHICAGO 45, Illinois**
Hugh Marsland & Co., 6405 N. California Ave.
9. **MINNEAPOLIS 4, Minnesota**
H. M. Richardson & Co., 9 East 22nd Street
10. **KANSAS CITY, Missouri**
Everett Associates, 1629 East 31st Street
11. **DALLAS 1, Texas**
J. Y. Schoonmaker Co., 2011 Cedar Springs Ave.
12. **PORTLAND 16, Oregon**
James L. Kearns, P. O. Box 5108
13. **HOLLYWOOD 28, California**
Gerald B. Miller Co., 1550 N. Highland Ave.
Offices: Albuquerque, N. M., San Francisco, California
14. **DENVER, Colorado**
R. G. Bowen, 446 Broadway

Brush Electronics Company, Dept. BB-8
3405 Perkins Avenue, Cleveland 14, Ohio

Please send bulletin on the SURFINDICATOR.

Your name .....

Company .....

Position .....

Address .....

City ..... *State* .....

BRUSH ELECTRONICS COMPANY

INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZO-ELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT
ULTRASONIC EQUIPMENT

formerly
The Brush Development Co.
Brush Electronics Company
is an operating unit of
Clevite Corporation.

GREENLEE Automatics

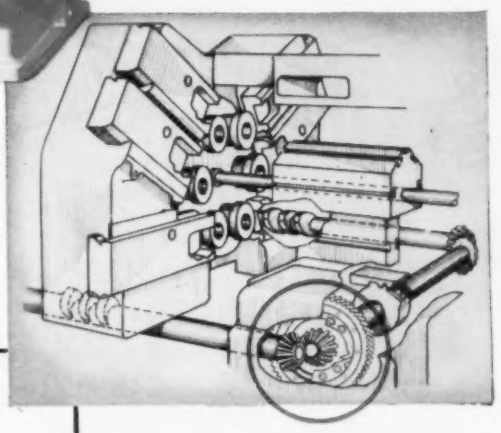
Left, a close-up of how the clutch-shifting dog on the worm wheel is set to desired position on a graduated scale. This sets the feed stroke of the main tool-slide.

QUICK AND EASY FEED STROKE ADJUSTMENT

On Greenlee Automatics, main tool-slide feed stroke adjustments are made by adjusting only one dog on a graduated worm wheel, as illustrated by the inset picture at the left. The details of this arrangement, and particularly the relation of the worm wheel to the main tool-slide drive, are shown and explained in the other pictures and captions.

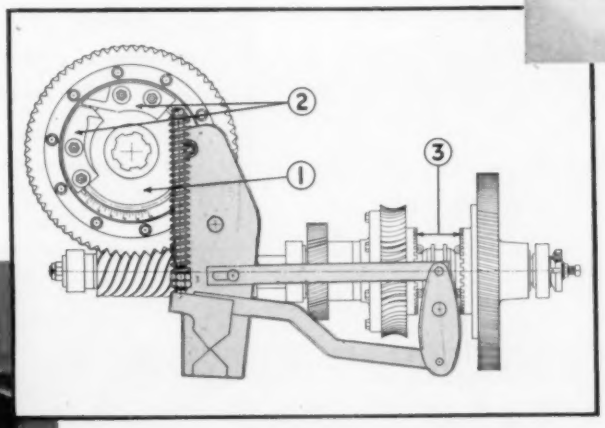
Changes can be made in 5 minutes

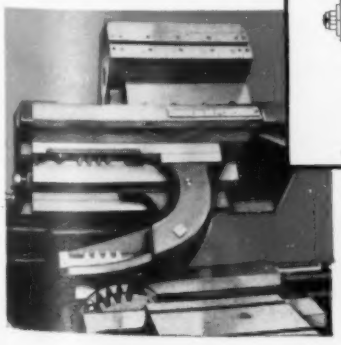
Precise adjustments of the main tool-slide stroke can be made easily in less than five minutes. To save time in making preliminary settings, two additional scales are provided, one on each side of the tool-slide, with graduations corresponding to those on the worm wheel.



The cutaway diagram above shows, in the circle, the location of the graduated worm wheel on the end of the shaft that carries the intermittent feed gears.

The drawing at the right shows how the clutch, worm and worm wheel, and clutch shifting levers are related. Numbers indicate (1) the graduated worm wheel, (2) the clutch shifting dogs, and (3) the main drive clutch.





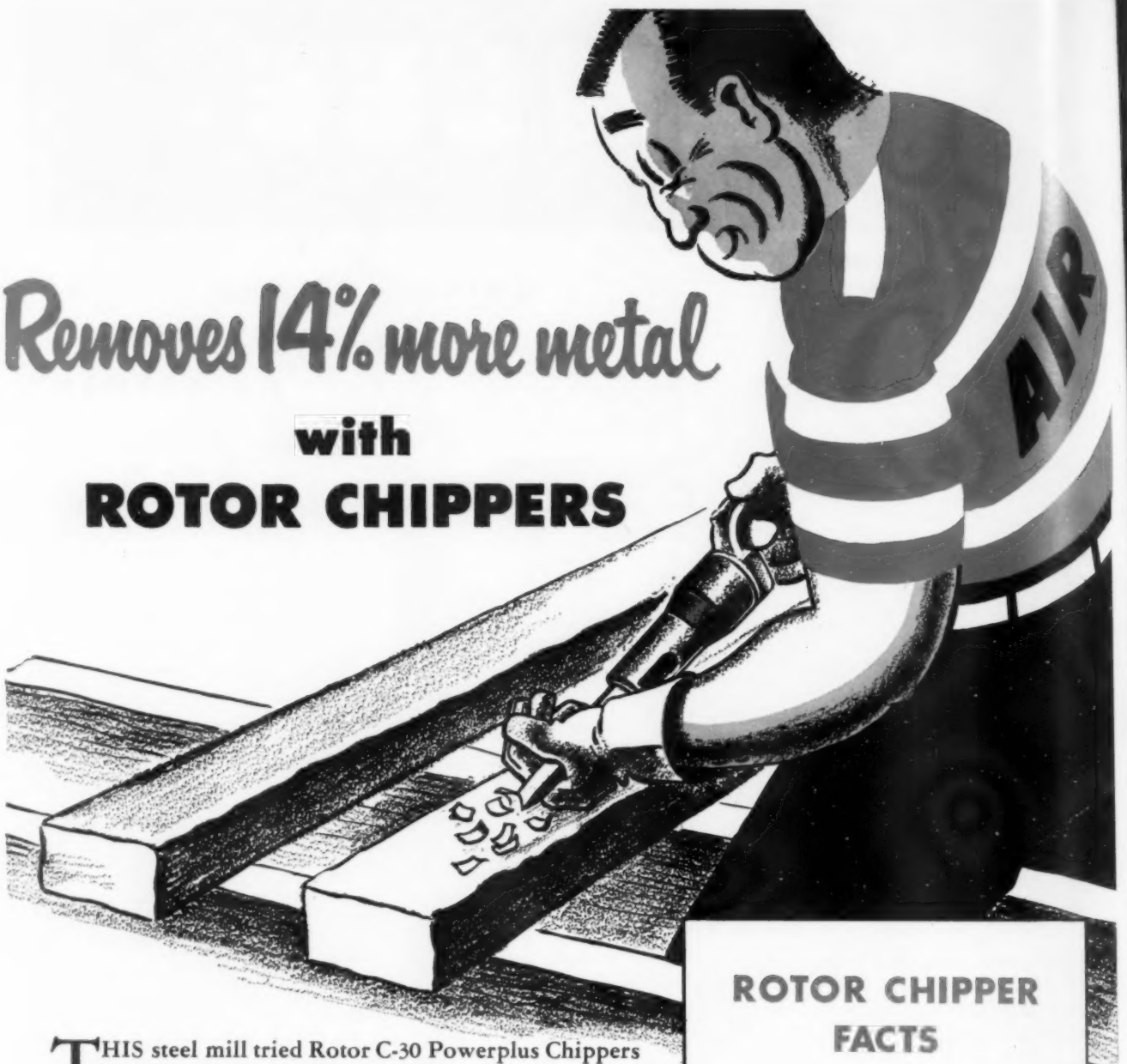
At the left is a view of the tool-slide removed and tilted back. The intermittent feed gear provides a full stroke each cycle, with fast approach and a smooth shift into feed. The main clutch is shifted automatically.

Write for FREE Literature

PRODUCTION MACHINERY

GREENLEE

GREENLEE BROS. & CO.
1988 MASON AVE., ROCKFORD, ILL.



Removes 14% more metal with ROTOR CHIPPERS

THIS steel mill tried Rotor C-30 Powerplus Chippers for 3 months and proved their superiority by time studies which showed *14% more metal removed* from 45 to 55 carbon shell stock than with former hammers. Operators say they like them better too—they're *shorter, lighter, and they handle easier.*

Put these new Rotor Chippers to the test on *your* operations! Ask for a demonstration or trial No obligation. Write for free copy of Catalog 37.

ROTOR CHIPPER FACTS

LIGHTER . . . 1½ to 3 lbs. less than other chippers.

SHORTER . . . 1" to 2" shorter . . . easier to get into crowded corners.

MATCH YOUR JOB . . . Each basic model can be adapted to three kinds of work.

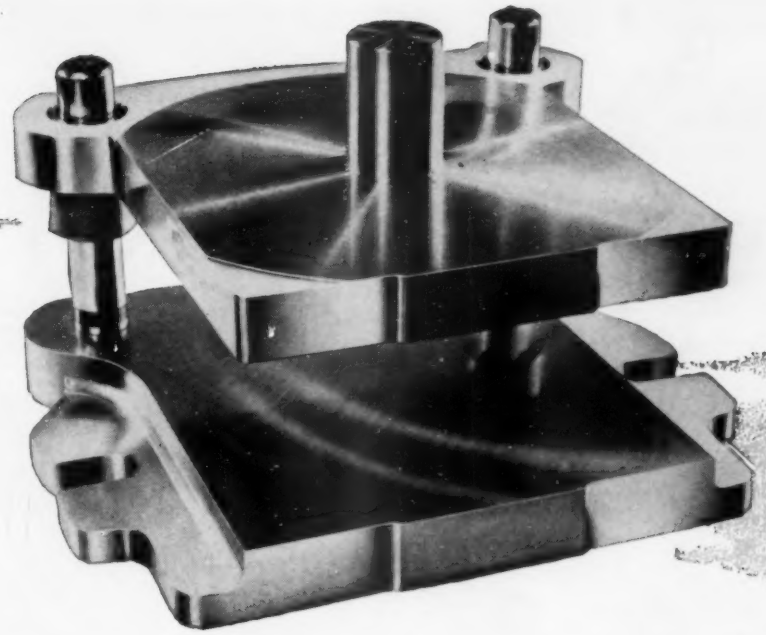
AIR

THE ROTOR TOOL CO.

CLEVELAND, OHIO

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

HIGH CYCLE

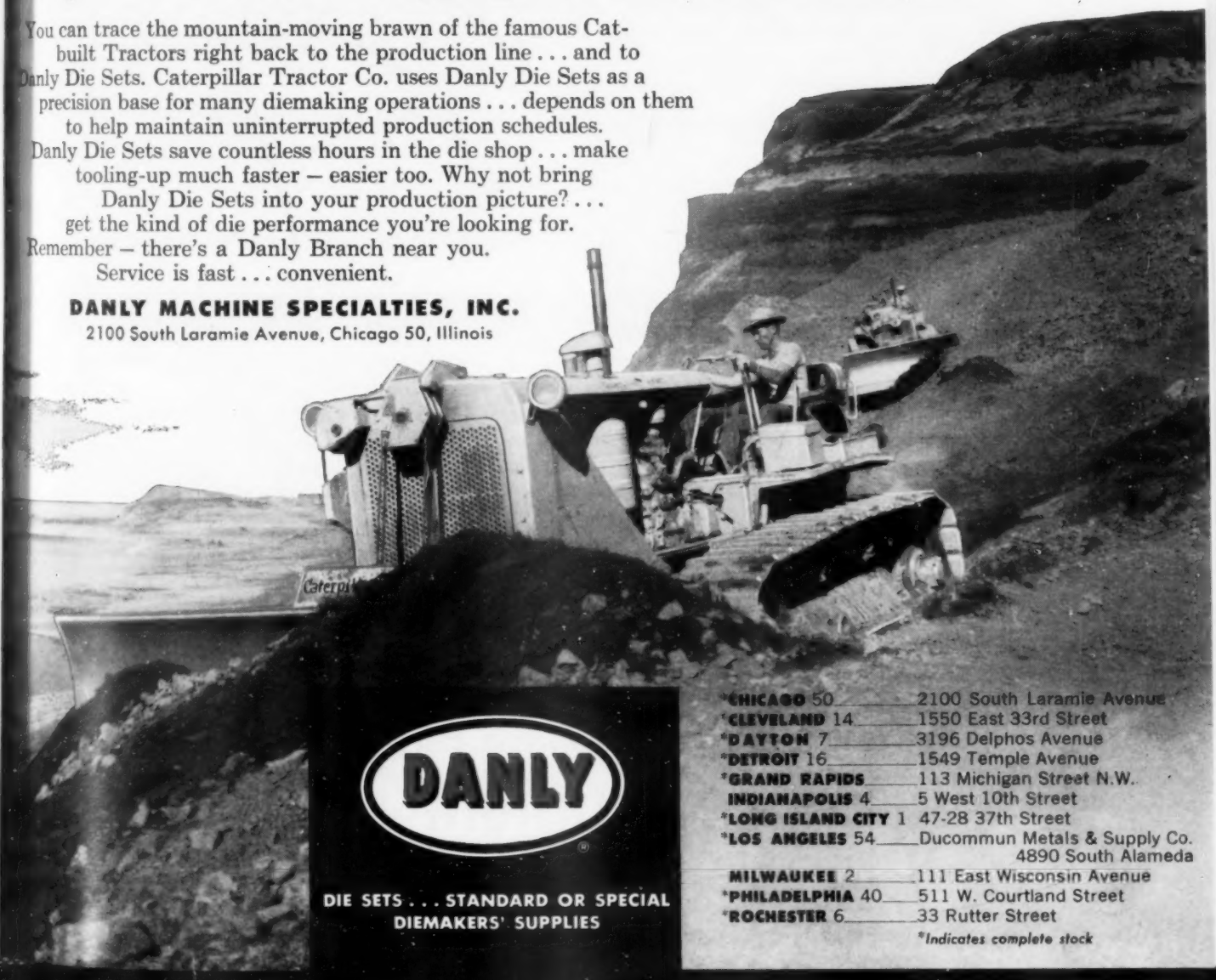


DANLY DIE SETS

help build the mighty Cat Diesel Tractor

You can trace the mountain-moving brawn of the famous Cat-built Tractors right back to the production line . . . and to Danly Die Sets. Caterpillar Tractor Co. uses Danly Die Sets as a precision base for many diemaking operations . . . depends on them to help maintain uninterrupted production schedules. Danly Die Sets save countless hours in the die shop . . . make tooling-up much faster – easier too. Why not bring Danly Die Sets into your production picture? . . . get the kind of die performance you're looking for. Remember – there's a Danly Branch near you. Service is fast . . . convenient.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois



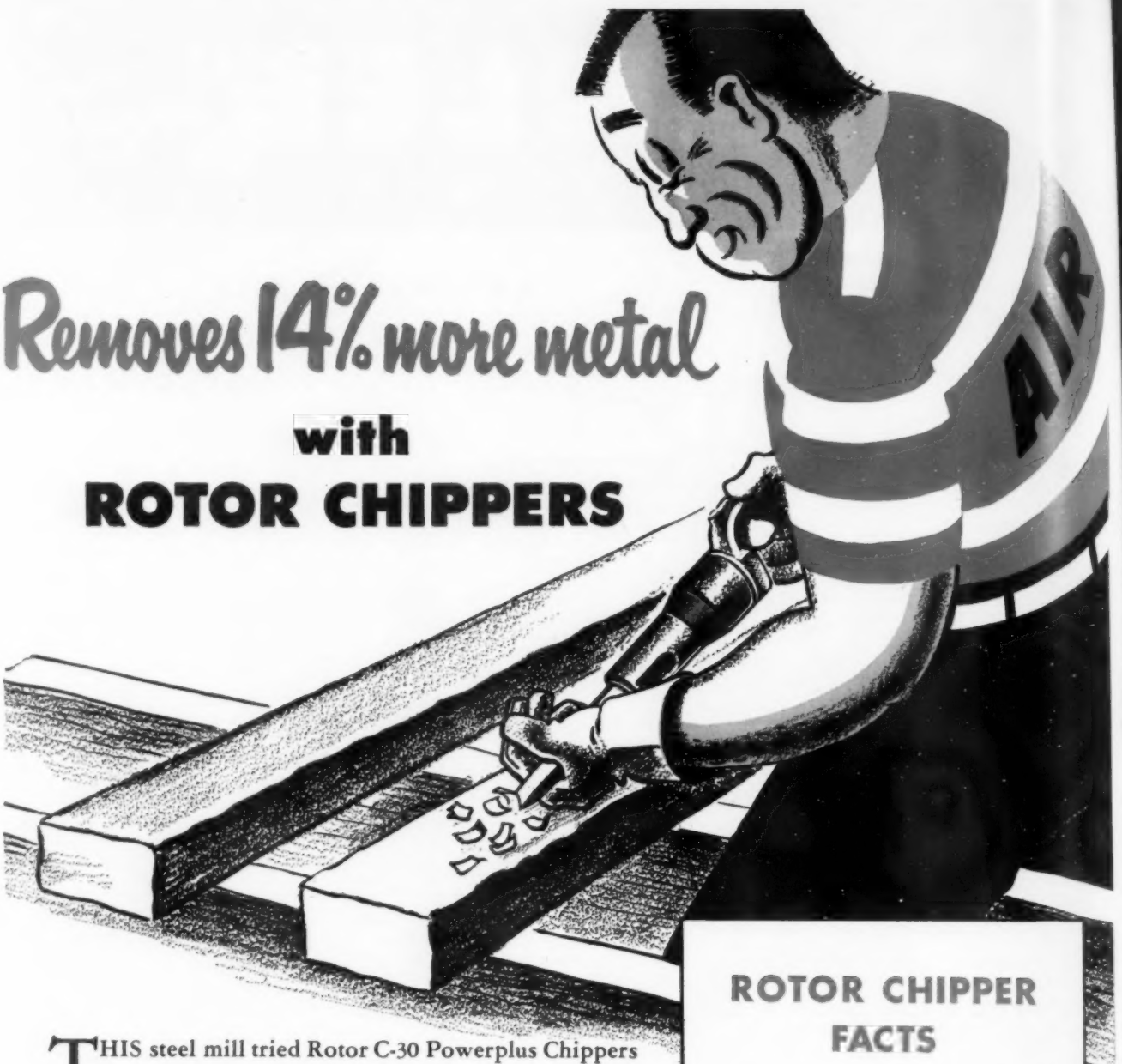
DANLY

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

*CHICAGO 50	2100 South Laramie Avenue
*CLEVELAND 14	1550 East 33rd Street
*DAYTON 7	3196 Delphos Avenue
*DETROIT 16	1549 Temple Avenue
*GRAND RAPIDS	113 Michigan Street N.W.
INDIANAPOLIS 4	5 West 10th Street
*LONG ISLAND CITY 1	47-28 37th Street
*LOS ANGELES 54	Ducommun Metals & Supply Co. 4890 South Alameda
MILWAUKEE 2	111 East Wisconsin Avenue
*PHILADELPHIA 40	511 W. Courtland Street
*ROCHESTER 6	33 Rutter Street

*Indicates complete stock

Removes 14% more metal with ROTOR CHIPPERS



THIS steel mill tried Rotor C-30 Powerplus Chippers for 3 months and proved their superiority by time studies which showed *14% more metal removed* from 45 to 55 carbon shell stock than with former hammers. Operators say they like them better too—they're *shorter, lighter, and they handle easier.*

Put these new Rotor Chippers to the test on *your* operations! Ask for a demonstration or trial No obligation. Write for free copy of Catalog 37.

ROTOR CHIPPER FACTS

LIGHTER . . . 1½ to 3 lbs. less than other chippers.

SHORTER . . . 1" to 2" shorter . . . easier to get into crowded corners.

MATCH YOUR JOB . . . Each basic model can be adapted to three kinds of work.

AIR

THE ROTOR TOOL CO.

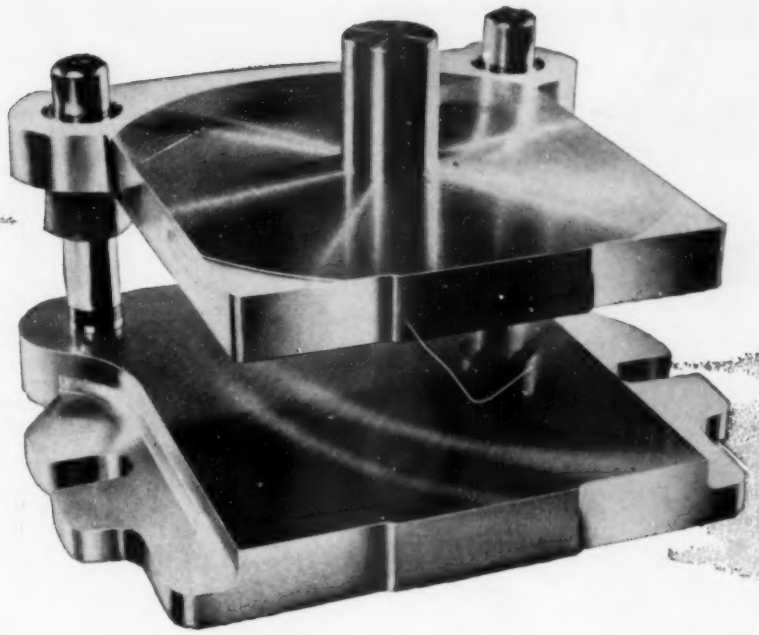
CLEVELAND, OHIO

HIGH CYCLE

UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS

DIEMAKERS' SUPPLIES

*Indicates complete stock

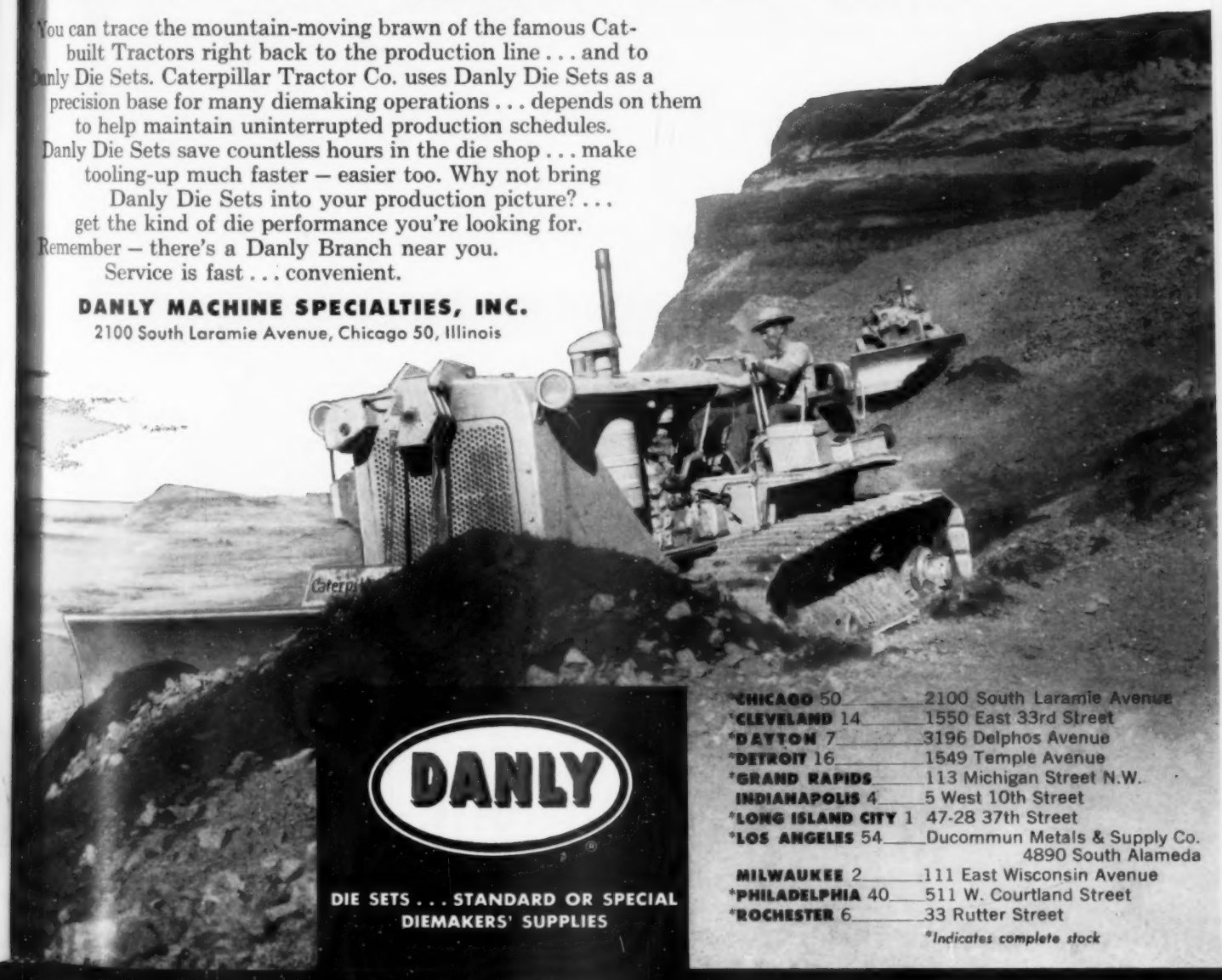


DANLY DIE SETS

help build the mighty Cat Diesel Tractor

You can trace the mountain-moving brawn of the famous Cat-built Tractors right back to the production line . . . and to Danly Die Sets. Caterpillar Tractor Co. uses Danly Die Sets as a precision base for many diemaking operations . . . depends on them to help maintain uninterrupted production schedules. Danly Die Sets save countless hours in the die shop . . . make tooling-up much faster – easier too. Why not bring Danly Die Sets into your production picture? . . . get the kind of die performance you're looking for. Remember – there's a Danly Branch near you. Service is fast . . . convenient.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois



DANLY

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

*CHICAGO 50	2100 South Laramie Avenue
*CLEVELAND 14	1550 East 33rd Street
*DAYTON 7	3196 Delphos Avenue
*DETROIT 16	1549 Temple Avenue
*GRAND RAPIDS	113 Michigan Street N.W.
INDIANAPOLIS 4	5 West 10th Street
*LONG ISLAND CITY 1	47-28 37th Street
*LOS ANGELES 54	Ducommun Metals & Supply Co. 4890 South Alameda
MILWAUKEE 2	111 East Wisconsin Avenue
*PHILADELPHIA 40	511 W. Courtland Street
*ROCHESTER 6	33 Rutter Street

*Indicates complete stock

So You Want to Make a MILLION?

...then follow this procedure

1. Get CARMET carbide metal dies and equip your presses with them.
2. Make 1,000,000 small stampings a day with only *one* grind per day.
3. Save $56,907 annually by using Carmet, as shown in the following cost comparison:

WITH CARMET		WITH HI-CARBON, HI-CHROME	
★ 4½ Dies per year	$30,600	★ 22 Dies per year	$ 46,750
★ Punch Replacements per year	$(none)	★ Punch Replacements per year	$ 6,600
★ 260 Grinds per year	$14,560	★ 4,420 Grinds per year	$ 47,424
★ Diamond Wheel Cost per year	$ 792	★ Abrasive Wheel Cost per year	$ 2,085
ANNUAL COST WITH CARBIDE	$45,952	ANNUAL COST WITH FERROUS	$102,859

4. Make millions *more* precision pieces a year than you could with hi-carbon, hi-chrome dies!

Ask the Carmet representative to figure out the potential savings and increased production for you in terms of your own work. ● *Allegheny Ludlum Steel Corporation, Carmet Division, Wanda & Jarvis Avenues, Detroit 20, Michigan.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

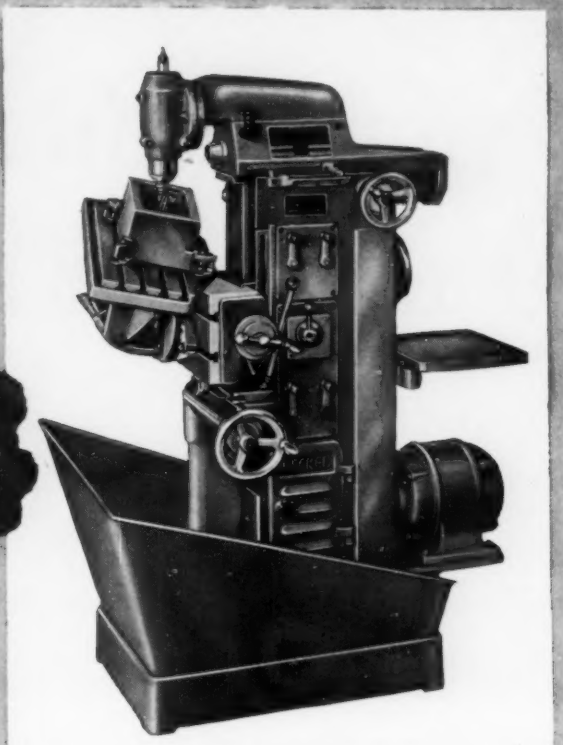
W&D 4066

AL FINE TOOL STEELS SINCE 1854

DIEMAKERS' SUPPLIES

*Indicates complete stock

Complex MACHINING SIMPLIFIED WITH VERSATILE DECKEL UNIVERSAL MILLERS



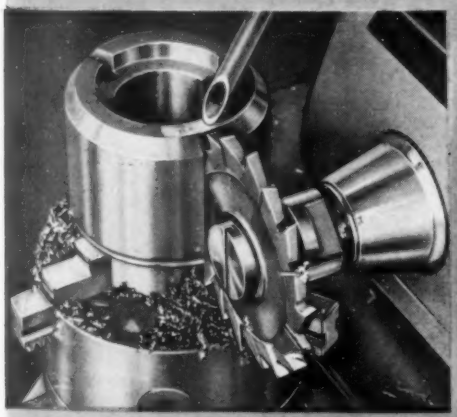
Model FP1 Universal Miller with Vertical Head and Swiveling Angular Table

When your job sheets call for horizontal, vertical, angular or spiral milling—drilling—boring or slotting, plan the job for one machine—a Deckel FP1 Universal Miller. You will find it the most efficient machine to do *all* these operations—accurately, easily and economically. With the various attachments, work holders and indexing fixtures you can produce complicated tools or parts with one set-up and eliminate costly special tools, jigs or fixtures.

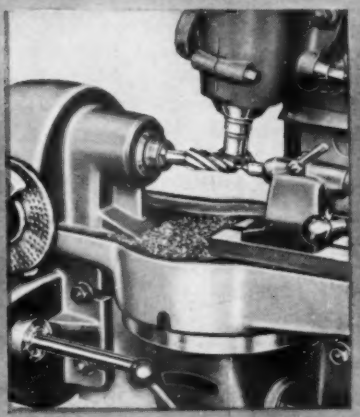
Other Deckel Machines for Tooling & Production

2 DIMENSIONAL ENGRAVERS
3 DIMENSIONAL ENGRAVERS
UNIVERSAL PANTOGRAPH DIE SINKER
UNIVERSAL TOOL & CUTTER GRINDERS

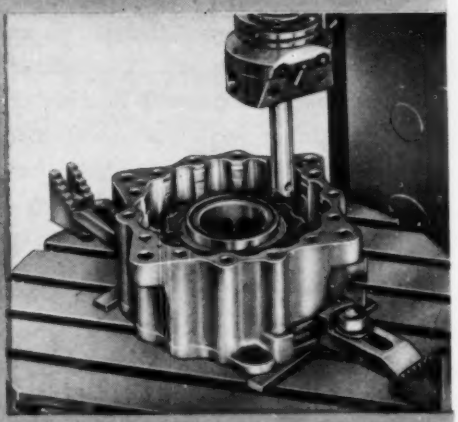
Slot milling using Universal Index Head



Milling flutes of a tapered cutter with Spiral Milling Attachment



Boring a barrel-type pump housing on the FP1 using the Universal Facing & Boring Head and Circular Table with Indexing Mechanism



See how the DECKEL Universal Miller can simplify your complex multiple machining operations. Write for complete catalog or ask that a Cosa engineer discuss with you the advantages of these practical machine tools.

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools—from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich

If you're in the market for special machines or special tooling...

Kearney & Trecker Special Machinery Division—an old hand in the business—has a brand new plant and greatly expanded facilities to build the big or small special equipment you need

THOUGH we've designed and built up to $3,000,000 worth of special machinery annually . . . have been in the field since 1898 . . . we've never publicized the fact till recently. Limited production facilities prevented taking additional orders.

But now we have a new plant built exclusively to produce special machines, special tooling and special adaptations of standard equipment. This plant, with approximately 200,000 sq. ft. of floor space, is equipped with more than $2,500,000 worth of the very latest tools and equipment. It's at your service.

We've worked with the best of them

In practically every industry . . . automotive, shoe machinery, aviation, etc. . . . there have been many installations of Kearney & Trecker special machines. These machines were custom-built to solve unusual metalworking problems. They provide extremely high production even with exacting dimensional accuracy and fine surface finish requirements.

We're staffed with engineers who have learned the business from the ground up

Our Special Machinery Division engineering section has almost 100 widely-experienced design, project and production engineers. These men are up-to-the-minute on the latest developments in applied mechanics, hydraulics, electronics, metallurgy and allied fields. They know exactly how to utilize these advances in the design and construction of outstanding special machine tools. In addition, it has a full complement of experienced machinists and mechanics needed for special machine construction.

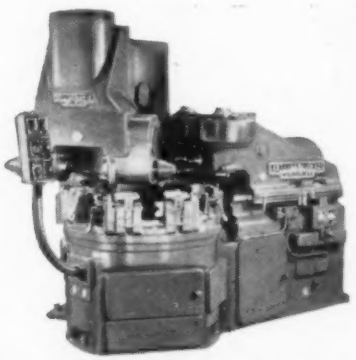
Every special machine is backed by the entire Kearney & Trecker organization

The Special Machinery Division is an integral part of Kearney & Trecker, a corporation that does an annual business in excess of $25,000,000. Every product, every commitment we make, is fully backed by our reputation for quality, cooperation and ability to live up to promises. Every machine is designed, then built, to your specific requirements with ample reserve for emergencies.

We invite your inquiry

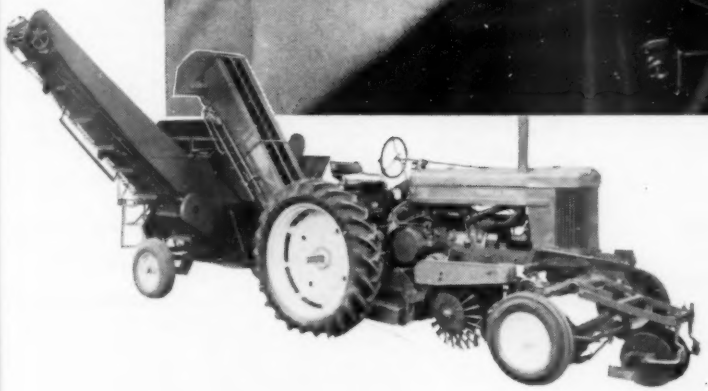
We'll be glad to provide you with any information we can . . . including sample machine specification sheets on typical installations, a brochure covering the expanded facilities of our Special Machinery Division, and details on our Customer Engineering Service. Furthermore, if you have special production machinery problems, have one of our senior Project Engineers analyze them, without obligation, of course.

Write, wire or phone the Special Machinery Division, Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.



We've built special machines or adaptations of standard equipment for practically every industry. Here is a photo of a three-station rotary indexing machine we designed and built for a major automotive manufacturer.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS ®



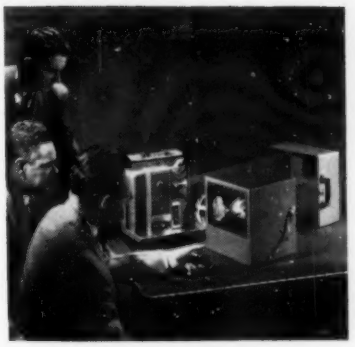
Here's the camera that helped JOHN DEERE build a better beet harvester

SOMETIMES high speed movies solve design problems in the most unexpected places. A sugar beet field, for example.

An experimental John Deere sugar beet harvester ran into a snag in field tests. Spinning spring teeth which remove the heavy, green tops prior to lifting the beet roots were failing in use. This was attributed to the recoil vibrations resulting from the weight of the tops and to rough, uneven ground which caused torsional deflections as great as 60 degrees.

To see exactly what happened, John Deere engineers carried their Kodak High Speed Camera out into the field and took movies of the fast-moving action at 1,000 and 3,000 frames a second. When the films were projected at normal speed, action was slowed almost 200 times. Study of the movies showed how steel or rubber dampeners would solve the problem. They also indicated how redesigning the mounting of the spring would further reduce recoil vibration.

The Kodak High Speed Camera may well be the tool that can help solve your problem of high speed mechanical action or fluid flow. It's easy to use and has the right speed range for most industrial applications. For full information send for a copy of our booklet. Or, write for details on a sound movie, "Magnifying Time."



For those who use high speed movies, the new Kodascope Analyst Projector makes detailed study easier than ever. It can be reversed and rerun all day long without overheating. Built into the carrying case is the Kodak Daylight Projection Viewer, eliminating the need for darkened rooms or bulky screens. For convenience, the reversing switch is on a five-foot cord. Information on the Kodascope Analyst Projector will gladly be sent on request.

Industrial Photographic Division
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the Kodak *HIGH SPEED* Camera

Kodak
TRADE-MARK

PRECISION CIRCULAR CUTTERS

MEYCO carbide tipped and solid carbide cutters have earned an enviable reputation in plants where long tool life and precision workmanship is a MUST.

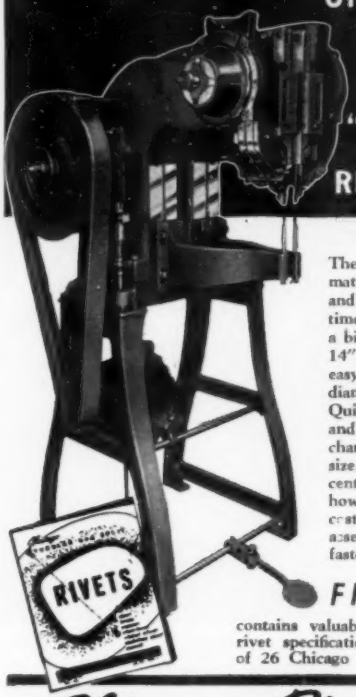
These cutters can be furnished in various diameters and thicknesses to meet the requirements of individual applications.

Saws and cutters, both carbide tipped and solid carbide, will aid production and precision in your slotting, venting, slitting and grooving operations . . . and they will be manufactured to your specifications. Please furnish complete specs and quantities desired when requesting prices and indicate material to be cut. MEYCO experience in the manufacture of precision tools, since 1888, is at your disposal.

W. F. MEYERS CO., INC., BEDFORD, INDIANA

USE READER SERVICE CARD; INDICATE A-8-186-1

CUT COSTS . . . FASTEN "ON THE DOUBLE" with the Chicago "214" DOUBLE RIVET SETTER



The "214" automatically feeds, inserts and clinches two rivets at a time . . . with speed that may mean a big saving in your fastening costs. 14" throat makes large assemblies easy to handle. For up to 9/64" diameter steel rivets—lengths to 7/8". Quick Change Rotary Type Hoppers and Raceways permit a 5-minute changeover to rivets of different size. Adjustable anvils and riveting centers add to its versatility. Ask us how the "214" can help you cut costs. Send a sample of problem assembly (or blue print) for Free fastening analysis.

FREE CATALOG

contains valuable engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters.

Chicago Rivet & MACHINE CO.

9619 West Jackson Boulevard, Bellwood (Chicago Suburb) Illinois

Branch Factory: Tyrone, Pa.

USE READER SERVICE CARD; INDICATE A-8-186-3

MULTIFORM BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BBB

Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅛"x1½" material.

Send for illustrated folder TE-5

J. A. RICHARDS CO. 903 North Pitcher St Kalamazoo, Michigan

USE READER SERVICE CARD; INDICATE A-8-186-2

MICRO COLLINS FLAT

BLACK GRANITE SURFACE PLATES

Present an absolute continuous bearing surface, finished up to 50 millionths inch. Incredibly smooth. Falling objects do not cause humps. Being harder than hardened steel, can take greatest mistreatment without causing inaccuracy of surface. No oiling. Will not rust or warp. No re-scraping or frequent refinishing. Can use for spotting and "blueing in."

Immediate delivery in most sizes from 9x12 to 48x144. **Request Bulletin** and name of Distributor nearest you.

COLLINS MICROFLAT CO.

2326 E. 8th Street Los Angeles 21, Calif.

USE READER SERVICE CARD; INDICATE A-8-186-4

CUT TOOL COSTS

broken tools made like new again with NU-TANGS

Twisted or broken tangs replaced at low costs on any tool with a Morse Taper (sizes 1 to 6) Hundreds of leading industries save money on drills, reamers, countersinks, cutters, drivers, the NU-TANG way. Prompt delivery. Send for prices—or send tools for repair. All work guaranteed.

NO WELDING! NO SLEEVES!
NO SHORTENING! NO DISTORTION!

Send them to us like this! **GUARANTEED STRONG AS NEW!** *We return them like this!*

★ *Patent No.* 2,372,033 **NU-TANGS INC.** 1337 Bates Avenue Cincinnati 25, Ohio

USE READER SERVICE CARD; INDICATE A-8-186-5

JONES & LAMSON GUARANTEES CLASS III THREADS with REPETITIVE ACCURACY!

J & L Automatic Opening Die Heads are sold with this guarantee: that your threads will be held consistently within the exacting Class III tolerances for form, lead and pitch diameter, throughout the long life of the J & L chasers.

FOR BROWN & SHARPE AUTOMATICS and SMALL TURRET LATHES
Capacities from #0 to 1¼"

RADIAL CHASER TYPE
Capacities from #8 to 4¼"

TANGENT CHASER TYPES
Stationary and Revolving. Capacities from #4 to 2"

Some of the reasons why:

COMPACT, RUGGED DESIGN GIVES MAXIMUM SUPPORT TO THE CHASERS. J & L Dies are made of solid steel, no built-up sections, hardened and precision ground throughout. Chasers are supported at the point of, and in the direction of, maximum strain.

THREAD FORM, HELIX, PRECISION POINT HEIGHT, ARE ALL GROUND INTO CHASERS AFTER HARDENING. This gives you a freer cutting tool, operating with minimum wear and repetitive Class III accuracy. The high precision of the J & L chasers is maintained in the Die by exclusive chaser holding features.

EASY, CONTROLLED RESHARPENING. J & L chasers are resharpened independently of the holders or dies. Instructions are simple, easy to follow. Eliminates guesswork. Exclusive holding features assure accurate resetting.

P.S. *Only J & L Die Heads and Chasers give you ALL these features. Write to Dept. 710 for illustrated catalogs and complete information.*

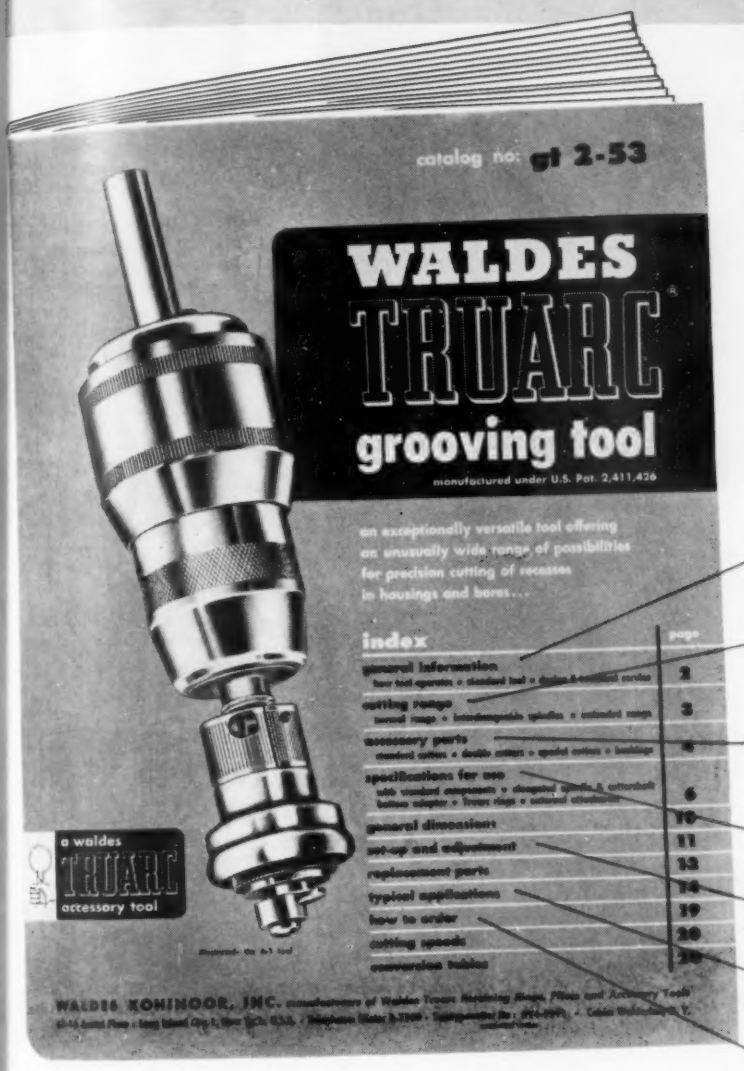
JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 518 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

J&L DIE HEAD DIVISION

Now, a complete new 20-page catalog for the Waldes Truarc Grooving Tool



• • • the One Versatile Tool Designed for High Speed, Precision Cutting of Internal Grooves in Housings and Bores

Here is the most complete catalog ever published—on the cutting of internal concentric recesses. Complete with descriptive, illustrated information and data charts showing how the Waldes Truarc Grooving Tool can solve virtually every internal grooving problem you may have. Shows how even *unskilled labor* can perform precise, production-line operations.

Facts and figures on the Waldes Truarc Grooving Tool . . . its special features, modifications and adaptations.

Data showing how the Waldes Grooving Tool cuts accurate grooves in housings with diameters from .250 to 5.000 inches.

Charts describing various cutters: single, multiple, beveled and special profiles. Description of bottom adaptors, elongated spindles, and extended bushings . . . for solving particular problems.

Location of grooves under varying conditions: in bores, housings, and blind holes.

Diagrams and easy-to-follow instructions on the set-up of the Grooving Tool.

5 full pages showing 17 case histories covering the range of typical problems and solutions.

Complete information on how to select the right model tool . . . and the right accessories . . . for your particular job.

WRITE *NOW* FOR THIS NEW 20-PAGE CATALOG

WALDES
TRUARC
REG. U. S. PAT. OFF.
GROOVING TOOL

MADE BY THE MANUFACTURERS OF WALDES TRUARC RETAINING RINGS.

WALDES KOHINOOR, INC., 47-16 Austel Place, Long Island City 1, N. Y.

Waldes Truarc Grooving Tool manufactured under U. S. Pat. 2,411,426

TE

Waldes Kohinoor, Inc., 47-16 Austel Place
Long Island City 1, New York

Please send me your new 20-page Catalog on the Waldes Truarc Internal Grooving Tool.

Name_____

Title_____

Company_____

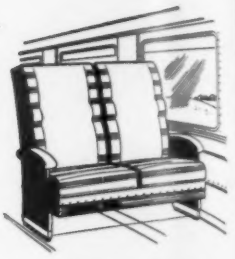
Business Address_____

City_____ Zone____ State_____

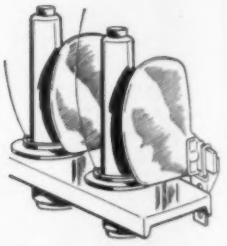
UNBRAKO BUTTON HEAD SOCKET SCREWS feature the following: threads to head; low head height; nonslip internal wrenching; hex socket that minimizes possibility of marred or mutilated heads; fully formed threads—Class 3 fit; heat treated alloy steel; standard sizes from # 8 through ⅝" diameter.

Our Fiftieth Year

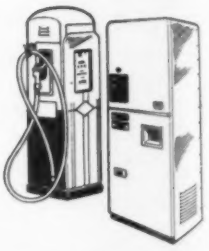
A START FOR THE FUTURE



USE UNBRAKO BUTTON HEAD SCREWS on transportation equipment—door and window frames, paneling, seats.



On textile machinery—slashers, twisters, bobbin shields.



On sheet metal assemblies—beverage coolers, gasoline pumps.

Have you checked our UNBRAKO standards?

We suggest you do, because a standard UNBRAKO delivered from your distributor's stock means faster and better service. A standard will do the job as well as a special at much lower cost. For details about UNBRAKO Standards, write STANDARD PRESSED STEEL Co., Jenkintown 37, Pa.

Write for UNBRAKO Standards

UNBRAKO® SOCKET SCREW DIVISION

sps

JENKINTOWN PENNSYLVANIA

Step up your internal grinding... boost your profits ...with this new

"TOUCH OF GOLD"

High production hits its peak when the "Touch of Gold" is added with Norton G Bond wheels for internal grinding.

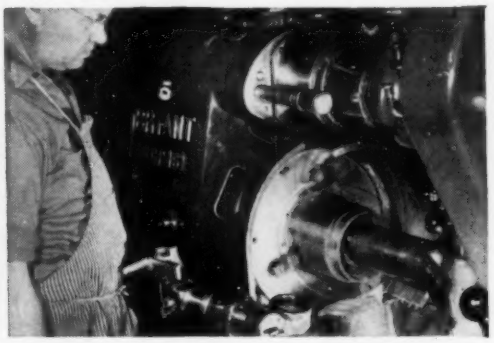
Norton G BOND wheels are precision-processed for identical precision-performance

Built by Norton's exclusive *precision-processing*, the new Norton G Bond wheels for internal grinding are completely uniform in structure. Just pull off a worn out wheel and slip on a new one — and you'll get exactly the same grinding action every time. Eliminating the fussing with the timing cycle, they save you time and money on every job.

Added to this, the new Norton G Bond, designed for precision and semi-precision grinding, is one of the greatest advancements in vitrified bonds ever made. Holding each abrasive grain for maximum cutting action, it assures a constant grinding surface of fresh, sharp cutting edges. As a result, G Bond wheels cut cooler . . . remove material faster . . . produce a better finish . . . produce more pieces per dressing . . . hold their shape better.

Thoroughly job-proved. Typical reports from internal grinding customers after switching to G Bond wheels: *Total pieces per wheel jumped from 200 to 400... Twice as many roller bearing races ground per dressing . . . Grinding cycle reduced from 7/10 minute to 4/10 minute ...Pieces per dressing increased from 9 to 15.*

Precision-processed for identical top performance, Norton G Bond wheels help cut costs on this centerless internal grinding job.



A faster, *better* finish on this aircraft engine cylinder is assured. Norton G Bond internal grinding wheels are on the job!

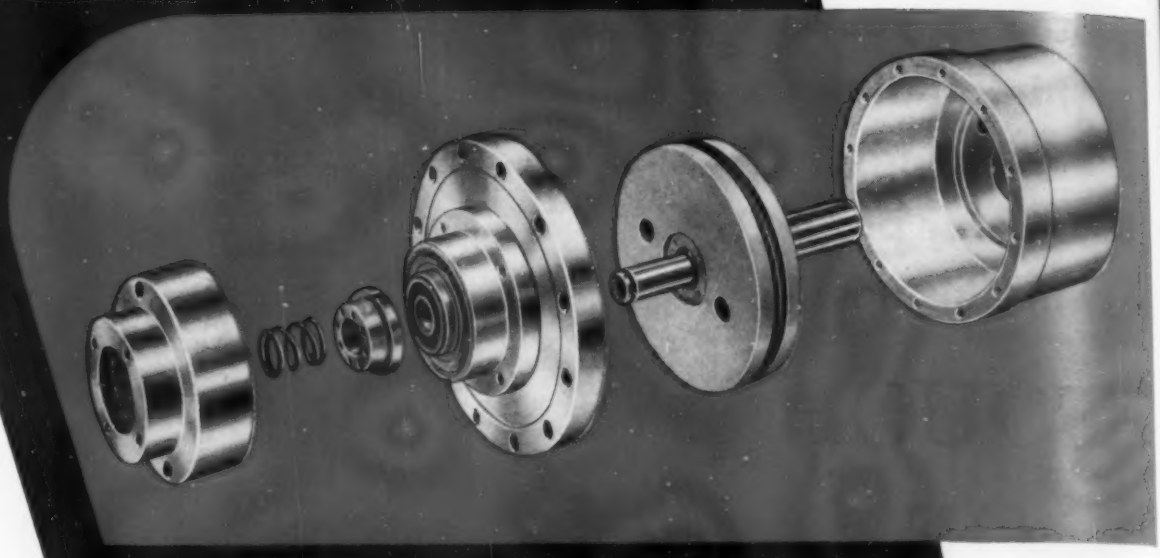
W—1507

See your Norton distributor for further facts on this value-adding, profit-boosting "Touch of Gold" for your internal grinding. He'll gladly arrange a test in your plant. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities — see your telephone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

NORTON
ABRASIVES

Making better products... to make other products better

CUSHMAN



ALUMINUM AND IRON BODY AIR CYLINDERS

Simple, powerful, and trouble-free in operation, Cushman Rotating Air Cylinders set an entirely new standard for performance. Balanced and with few, rugged moving parts, they operate up to highest required speeds. Cushman engineers have also succeeded in perfecting the air control and power system to the point where applied pressures can be held dependable under production line operating conditions.

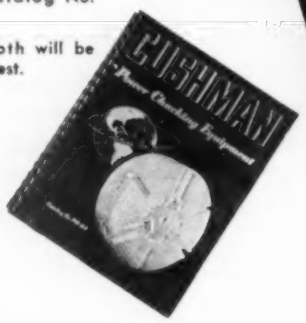
Any air chuck is completely dependent upon the efficiency of its operating air cylinder. Cushman Iron Body Rotating Air Cylinders have been designed to safeguard the performance of Cushman Precision Air Chucks, but may be used with other types too. Cushman Aluminum Body Rotating Air Cylinders provide equivalent performance at speeds up to the highest now being used. Low maintenance and long service life are inherent in this simplified design. Consult your distributor or write us direct for further information.

CONSERVE YOUR MAN-POWER

The Cushman Air Chuck Catalog No. PO-64-1952 covers our complete line of Air Chucks, Cylinders, and Accessories.

Cushman Manually Operated Chucks are separately described and listed in Catalog No. 65-1952.

Either or both will be sent on request.



THE CUSHMAN CHUCK COMPANY
817 WINDSOR STREET
HARTFORD 2, CONNECTICUT, U. S. A.
Chucking Engineers Since 1862

Manufacturers of
AIR CHUCKS, CYLINDERS, and ACCESSORY EQUIPMENT • THE CUSHMAN POWER WRENCH • CUSHMAN MANUALLY OPERATED CHUCKS and FACE PLATE JAWS.

A WORLD STANDARD FOR PRECISION

BCS53

WHAT IS YOUR TOUGHEST METAL CLEANING JOB?

HAVE YOU TRIED THE NEW OAKITE MATERIAL FOR IT?

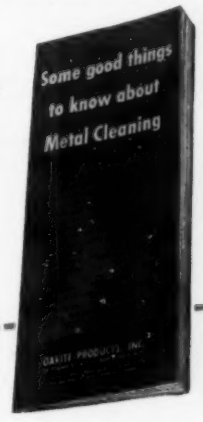
Oakite has new materials for many tough jobs

1. Heavy-duty cleaning in tanks
2. Cleaning sensitive metals
3. Etch-cleaning aluminum
4. Washing in pressure-spray machines
5. Electrocleaning zinc-base die castings
6. Cleaning magnesium alloys
7. Putting heavy phosphate coatings on steel in preparation for painting
8. Pickling and conditioning for painting in one operation
9. Cleaning, pickling and conditioning for painting in one operation
10. Stripping paint
11. "Killing" paint in spray booth wash water
12. Drawing and forming

During the past year, the Oakite Chemical Research Laboratory has produced 16 new or improved materials for performing 12 difficult metal-cleaning jobs and related operations.

One of these new materials may be the perfect answer for some metal-cleaning problem that's been giving you a lot of trouble. Just check the list of cleaning jobs, then circle the corresponding number in the coupon, and we'll be glad to tell you about the new chemical designed for your work.

FREE Our 44-page illustrated booklet *"Some good things to know about Metal Cleaning"* has been revised to discuss the applications of the 16 new materials.



OAKITE PRODUCTS, INC., 58 Rector St., New York 6, N. Y.

Send me a FREE copy of your booklet *"Some good things to know about Metal Cleaning."*

I am especially interested in some of the metal-cleaning jobs listed in your advertisement. Please give me more information about the new Oakite materials for the jobs indicated by the numbers circled below:

1 2 3 4 5 6
7 8 9 10 11 12

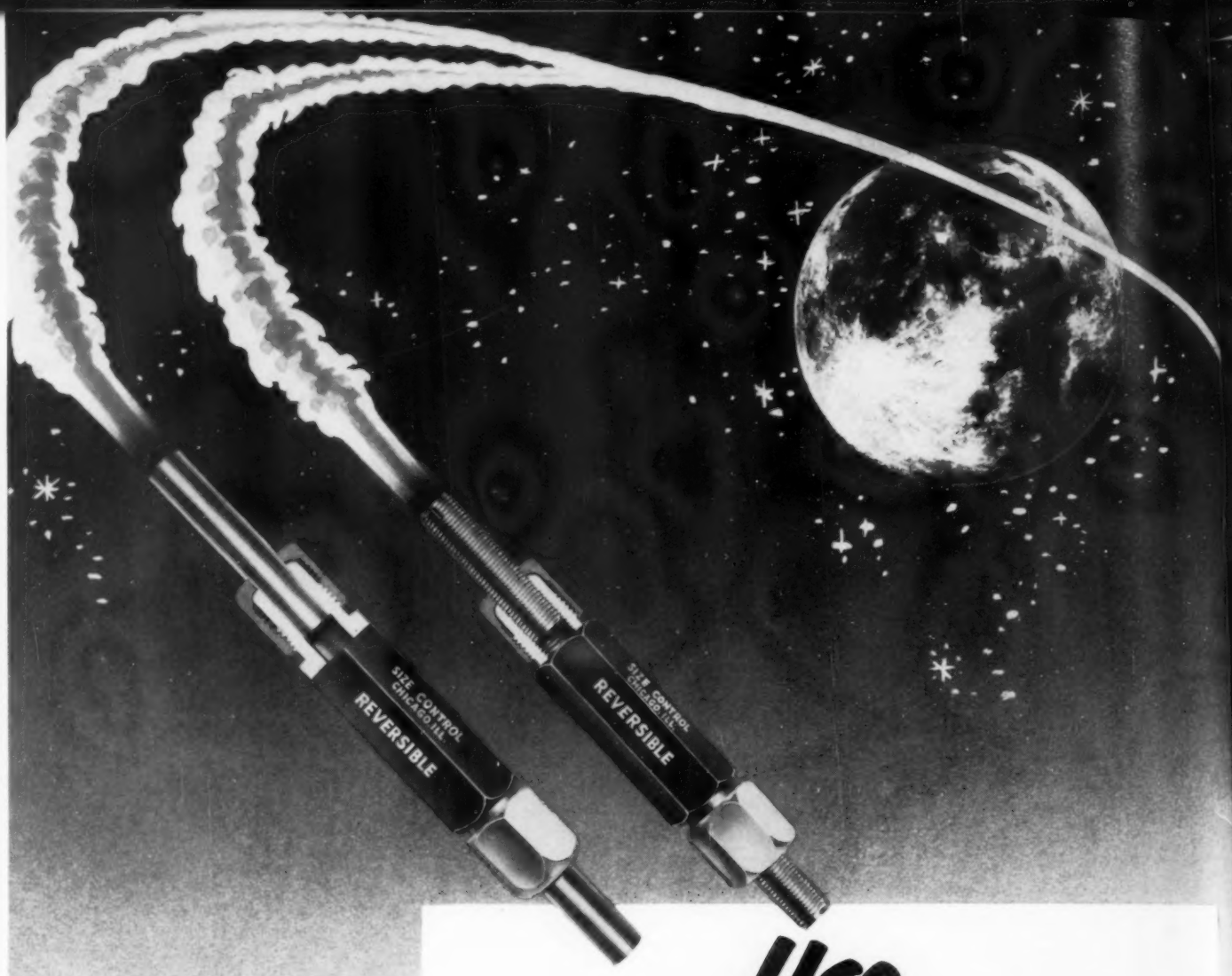
*Name*_____

*Company*_____

*Address*_____

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada



Use SIZE CONTROL *REVERSIBLE* PLUG GAGES

FOR FAST, ACCURATE GAGING AT LOWEST COST...

...our catalog 53 tells you how!

SIZE CONTROL COMPANY

2500 West Washington Boulevard • Chicago 12, Illinois • MOnroe 6-6710

Division of AMERICAN GAGE and MACHINE COMPANY

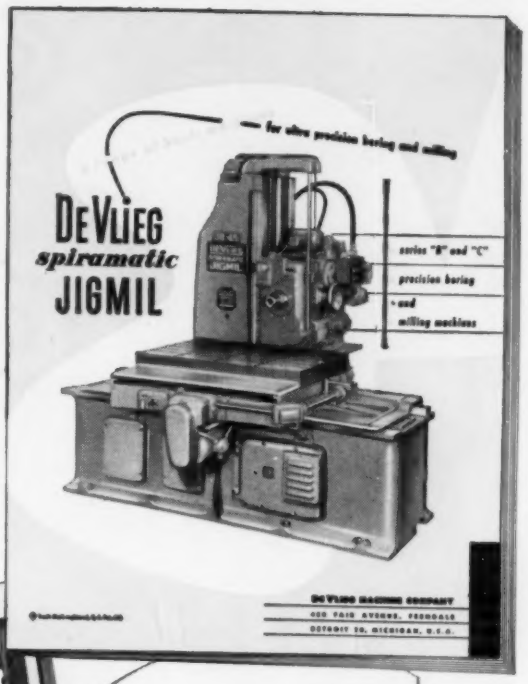
SIMPSON ELECTRIC COMPANY SIZE CONTROL COMPANY WALSH PRESS & DIE COMPANY

DEVLIEG OF DETROIT

MAKERS OF

Fine Machine Tools

Brings you a new comprehensive Catalog featuring the latest range of Spiramatic Jigmil Precision Boring and Milling Machines . . .



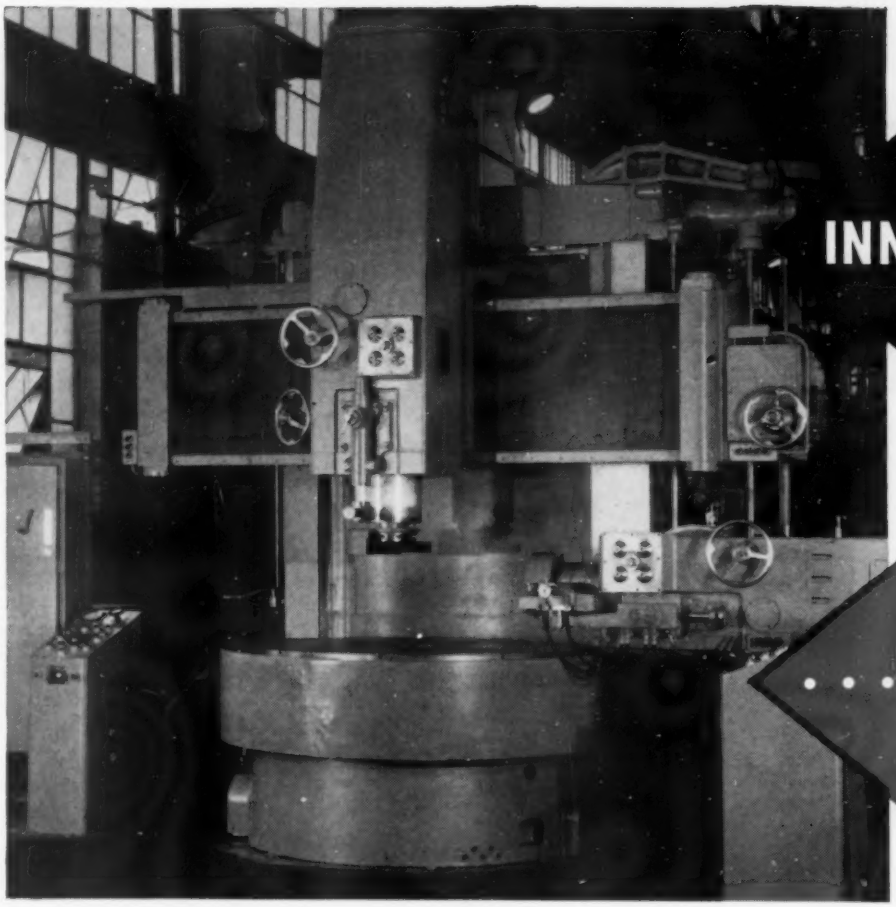
Precision plus Production

A request on your company letterhead will bring a free copy of this catalog!

for the latest developments in precision boring equipment . . . consult

DEVLIEG OF DETROIT

DE VLIEG MACHINE COMPANY 450 Fair Avenue, Ferndale, Detroit 20, Michigan



AN INNOVATION *in*

VERTICAL CHUCKING GRINDING MACHINES

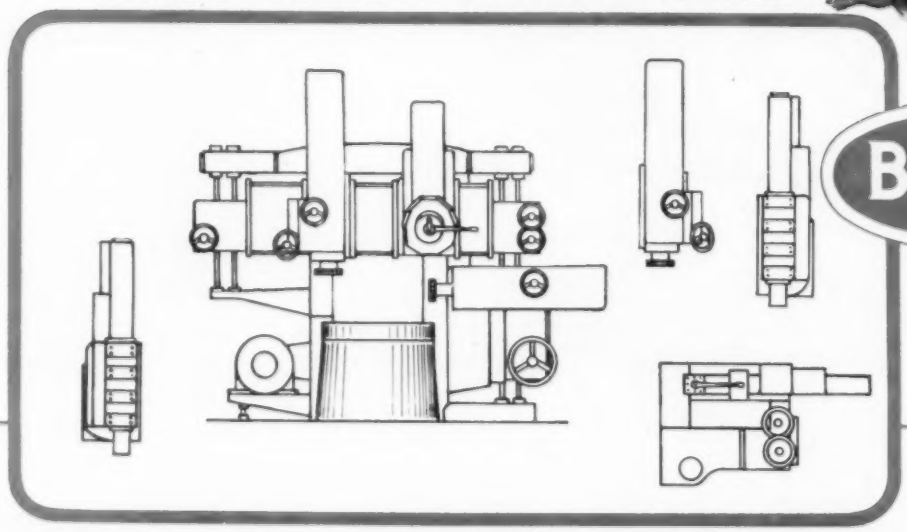
Your Grinding Jobs finished . . . Keep the Machine Paying Its Way . . .

NOW . . .
Practical Versatility

BY . . .
Grinding, Boring, Facing or Turning with several head combinations available.

ASSURED
Sufficient horsepower for regular machining cuts first . . .
Grinding work next . . . on the SAME machine.

POSSIBLE HEAD COMBINATIONS on BULLARD VERTICAL CHUCKING GRINDING MACHINES

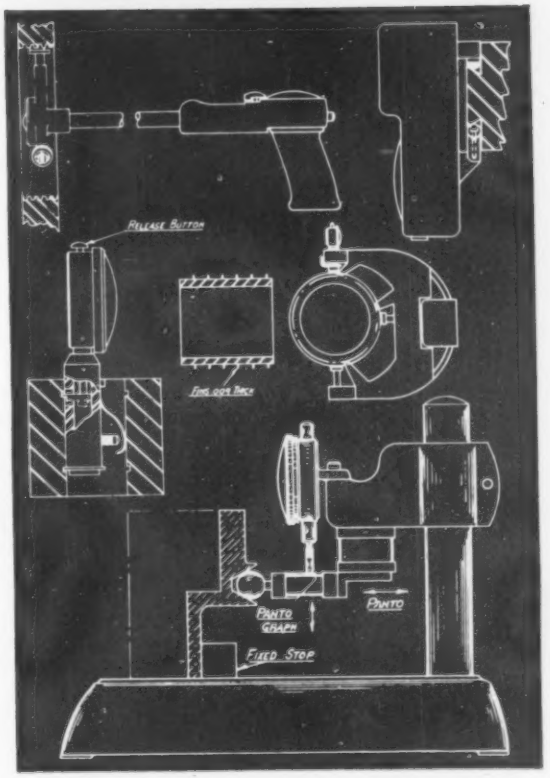


THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

Gages must be properly matched with your requirements

GETTING THE RIGHT GAGES . . . like marriage . . . is a cooperative arrangement: It requires confidence and close cooperation. You need to take advantage of the gage maker's specialized knowledge in designing and building precision gages — his knowledge of how to magnify and transfer measurement variations precisely, without loss of motion, with a minimum of friction and inertia in the working parts, and the hundred other details which do not concern the usual tool and machine designer — or *you* for that matter, in your daily production work.

No consulting engineer or tool making shop can possibly have the specialized knowledge of gages which Federal has. Many thousands of dollars are wasted annually by designing and building special gages which are already available as Federal catalog gages or catalog gages with slight modifications. Whether you need an Air or Automatic Gage or a Dial Indicator type, call in Federal when you *start* processing a job and let us engineer your gages for you. Federal Products Corporation, 1198 Eddy Street, Providence 1, Rhode Island.



The above drawings illustrate how catalog gages can be simply and inexpensively modified to suit a special requirement. Why go to greater expense and time? Call FEDERAL.

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing all types of DIMENSIONAL INDICATING GAGES

CLOTH

OPEN MESH SANDING FABRIC

PATENT APPLIED FOR

..."HEARD 'ROUND THE WORLD"!

★ 10 to 15 TIMES LONGER LIFE than the conventional types of coated abrasives.

★ NON-LOADING . . . OPEN MESH LETS THE REMOVED PARTICLES FLOW RIGHT THROUGH.

★ THOUSANDS OF SUPER-SHARP EDGES KEEP ON CUTTING.

★ USE WET OR DRY

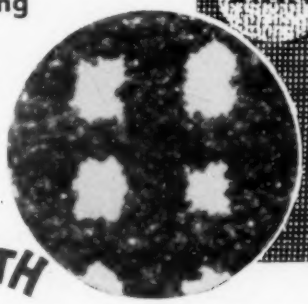
★ FLAT OR FOLDED

★ BY MACHINE OR HAND

★ BOTH SIDES

★ APPLICATIONS ARE LIMITLESS . . . each day finds a new successful operation for this Miracle Modern Sanding Fabric.

Where can YOU use it?



BAY STATE

GRITCLOTH

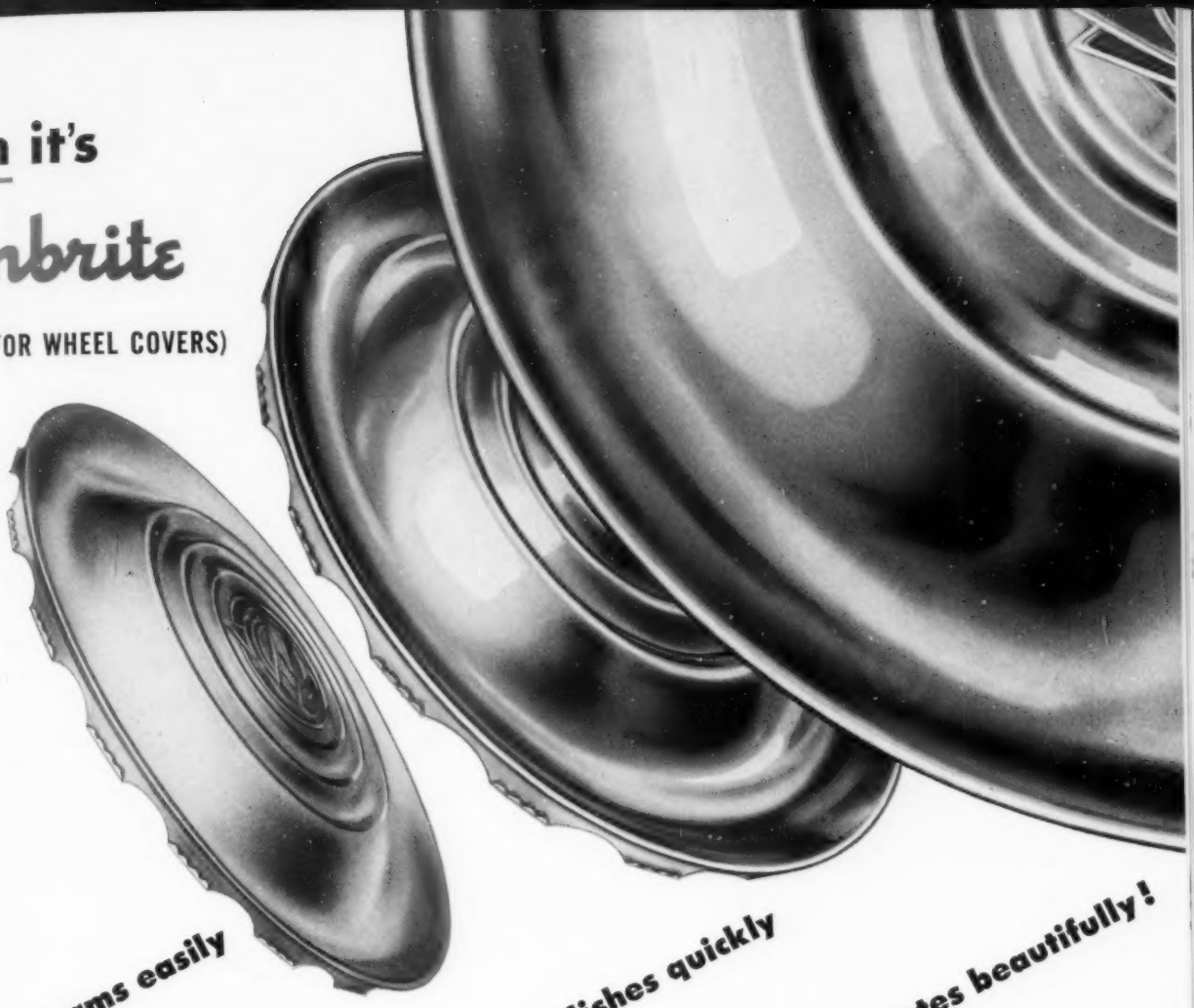
...A BAY STATE PIONEERED PRODUCT

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass., U. S. A.

Branch Offices and Warehouses — Chicago, Cleveland, Detroit, Pittsburgh
Distributors — All principal cities
In Canada: Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ont.

again it's Formbrite

(THIS TIME FOR WHEEL COVERS)



● it forms easily ● polishes quickly ● plates beautifully!

Canadian Motor Lamp Co., Limited, Ford, Ontario, is a large automotive parts supplier. When Canada's "Big Three" turned to full wheel covers in place of hub caps for many '53 models this supplier, suddenly facing a new set of production problems, turned to Formbrite*, exceptionally fine-grain Anaconda Brass. Here are the reasons:

1 Previous experience in manufacturing large quantities of chromium-plated brass hub caps made of Formbrite indicated that polishing operations could be reduced as much as 50%.

2 Formbrite had demonstrated its remarkable ductility for press operations—taking sharp, clean-cut, ornamental die impressions.

3 Formbrite was harder, stronger, springier and more scratch-resistant than ordinary drawing brass . . . desirable characteristics for the service involved.

4 Important, too, was the fact that Formbrite would provide the fatigue-resisting springiness to the gripping fingers that hold the cover to the wheel.

Now in full production on the new wheel covers, Canadian Motor Lamp's appraisals proved 100% correct. Maybe *you're* missing something by *not* using Formbrite. Write for Publication B-39, addressing The American Brass Company, General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

*Reg. U. S. Pat. Off. 5390

Shown above is one of the 16 sets of gripping fingers which hold the 15" diameter wheel cover to the rim. The metal is yellow brass, .024" thick, supplied in coil as Formbrite.

Formbrite DRAWING BRASS

An ANACONDA product made by The American Brass Company

PRESSURE

It's big business at U.S. Gauge where **brass belongs**

At Sellersville, Pa., millions of pressure gauges are made each year—for every type of industry—to every degree of accuracy—and for pressures ranging from a few ounces per square inch up to 100,000 pounds.

With each gauge a precision instrument unto itself, it's quite a job to maintain the high standards of routine fabricating procedure on each of its many components. Part of it depends on having just the right copper alloy in the most satisfactory combination of chemical and physical properties. That's where teamwork between U. S. Gauge and Anaconda Metals has been clicking day after day, year after year.

and now—something NEW has been added . . .

U. S. Gauge is now using Formbrite* for many of its "polished and lacquered" and chromium plated solid brass gauge cases. Formbrite, with its superfine grain, provides a surface far superior to ordinary drawing brass. It is stronger, harder, more scratch-resistant than ordinary brass, yet retains remarkable ductility for forming and drawing. Best of all, Formbrite is a real time saver when it comes to finishing operations.

Want to know more about this "premium product at a non-premium price"? Write for Anaconda Publication B-39. Address: The American Brass Company, General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. *Reg. U. S. Pat. Off.

Formbrite DRAWING BRASS

An **ANACONDA** Product

Made by The American Brass Company

Gauge and components courtesy of

UNITED STATES GAUG

DIVISION OF AMERICAN MACHINE AND METAL

Sellersville, Pa.

For the ultimate in precision, eleven different Anaconda Alloys in the form of rod, tube, sheet and strip are used in producing the components of the U. S. Gauge illustrated above.

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 133.

RADIUS FORMING TOOLS

"TRU-LINE" PROFILE DRESSING TOOLS

IMPREGNATED DRESSING TOOLS

STANDARD DRESSING TOOLS

"TRU-THREAD" THREAD DRESSING TOOLS

DIAMOND GRIT TOOLS FOR THREAD DRESSING

INDUSTRIAL DIAMONDS

The Charm of Booie, The Witch Doctor

Booie, the Kaffir witch doctor, didn't want to part with the charm. Often he had made big magic with it in his ceremonial dances and without it he might lose face. And, didn't it have miraculous powers?

Schalk van Niekirk, the old Boer trader, thought so—at least it had the power to make him a very wealthy man, for this pebble was four times the size of the one he had sold two years before.

So, all day long they haggled and Schalk brewed pot after pot of Dutch coffee, heavy with sugar, well flavored with a magical potion from a stone bottle and served it with the free hand of a man who feels a fortune tickling his fingertips.

Finally, he stood up, stamped out the fire and said, "Booie, come to my kraal and I will give you 500 sheep, 10 oxen, and a horse— I have nothing more." Booie held out his hand; suddenly, he was incredibly rich.

Schalk sold the big diamond—it weighed 83½ carats—for $56,000, a handsome fortune in 1870. In London, after cutting to 46½ carats, it proved to be of the finest color and brilliance, and the Countess of Dudley gladly paid $125,000 for it. In her tiara it became "The famous Dudley Diamond."

Diamonds are precious in industry, too, because they are still the greatest cutting element known to man. For 43 years we have been importing fine diamonds for our customers. Our field engineers are at your service.

WHEEL TRUEING TOOL COMPANY

17-3200 West Davison Avenue • Detroit 6, Michigan

ESTABLISHED 1910

Offices in Principal U. S. Cities—Agents Throughout the World

WHEEL TRUEING TOOL COMPANY OF NEW JERSEY
33 West Street, Bloomfield, N. J.

WHEEL TRUEING TOOL COMPANY OF CANADA, LTD.
575 Langlois Ave., Windsor, Ont.

VK HIGH SPEED STEEL THREAD MEASURING WIRES

...basic tools in a universally accepted method of checking screw threads

VK Set No. 20 HS Thread Measuring Wires, accurate to ±.000025" for 20 common pitch Unified and American screw threads, 6 to 36 threads per inch.

The three-wire method is probably the best known and most widely accepted system of measuring pitch diameter of screw threads. Equipment required includes only a set of VK Thread Measuring Wires of proper diameter and an accurate measuring instrument.

Van Keuren Thread Measuring Wires have been developed over a period of many years of pioneering in the precise measurement field. They are made to National Bureau of Standards specifications, are held within .00002" for roundness, straightness and identity and to within .000025" of exact size.

VK Thread Measuring Wires are made of long-wearing, tough and beautifully finished high speed steel and are either 1⅞" or 2" in length. Every wire is subjected to the closest criteria in today's standards of accuracy.

In addition to set No. 20, shown here, VK furnishes many other standard sets as well as special wires in diameters from .001" to 1.500."

The Van Keuren Catalog and Handbook No. 35 contains 91 pages of technical and engineering information on wire measurement of screw threads. This information, compiled from many years research in the field, is available without charge by addressing: The Van Keuren Co., 174 Waltham St., Watertown, Mass.

VK

34th YEAR

THE Van Keuren CO.,

174 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires

SERVICES AVAILABLE TO ASTE MEMBERS AND CHAPTERS

Items listed below are available for individual ASTE members and chapters at nominal charges shown.

MEMBER SERVICES

Membership Emblem Button for Juniors and Seniors, enamel on gold	$ 1.00
Chapter Chairman's Emblem Button, gold with Rubies	11.00
Past Chapter Chairman's Emblem Button, gold with Diamonds	38.00
Past Chapter Chairman's Emblem Button, gold with Sapphires	8.00
Membership Certificate, blue and gold print on white stock, unframed	2.00
Membership Certificate, same as above but framed in a black wood frame	2.75
The Tool Engineers Handbook, to members	11.00
The Tool Engineers Handbook, to non members	15.00
Data Sheets, to members	no charge
Data Sheets, to non members ..... per sheet	.10
Data Sheet Binder, ASTE Emblem and words DATA SHEETS imprinted	2.50
Zipper Binder, large, ASTE Emblem imprinted, space for other imprinting provided	8.50
1953 21st Annual Meeting Technical Papers ..... each	.50
or any 4 papers for	1.00
1953 21st Annual Meeting Panel Discussions ..... each	1.00
or 3 papers for	2.00
1953 21st Annual Meeting Technical Papers and Panel Discussions, complete bound volume	4.00

CHAPTER SERVICES

Gummed labels, addressed to Chapter membership ..... per hundred	.60
Window Envelope Inserts, addressed to Chapter membership ..... per hundred	.60
Letterhead Stationary, blue half tone with black letters bearing Chapter address ..... 250 for	3.50
500 for	5.00
per 1000	7.50
Return address envelopes, window or non window ..... per 1000	8.00
Second sheets, plain, white or yellow ..... per 1000	2.00
Copy sheets, white with AMERICAN SOCIETY OF TOOL ENGINEERS and COPY printed in black ..... per 1000	4.00
ASTE Banner, blue satin with gold lettering reading AMERICAN SOCIETY OF TOOL ENGINEERS and bearing ASTE emblem. Banner is complete with a rod inserted at the top and a gold colored cord for hanging.	15.00

(Imprinting of Chapter name and number can be done but at extra cost)

Orders for any of the above items must be accompanied by remittance. (ASTE Chapters may, upon request, have the purchase price deducted from their next allocation check) Please direct all orders to:

AMERICAN SOCIETY OF TOOL ENGINEERS

10700 Puritan Avenue **Detroit 21, Michigan**

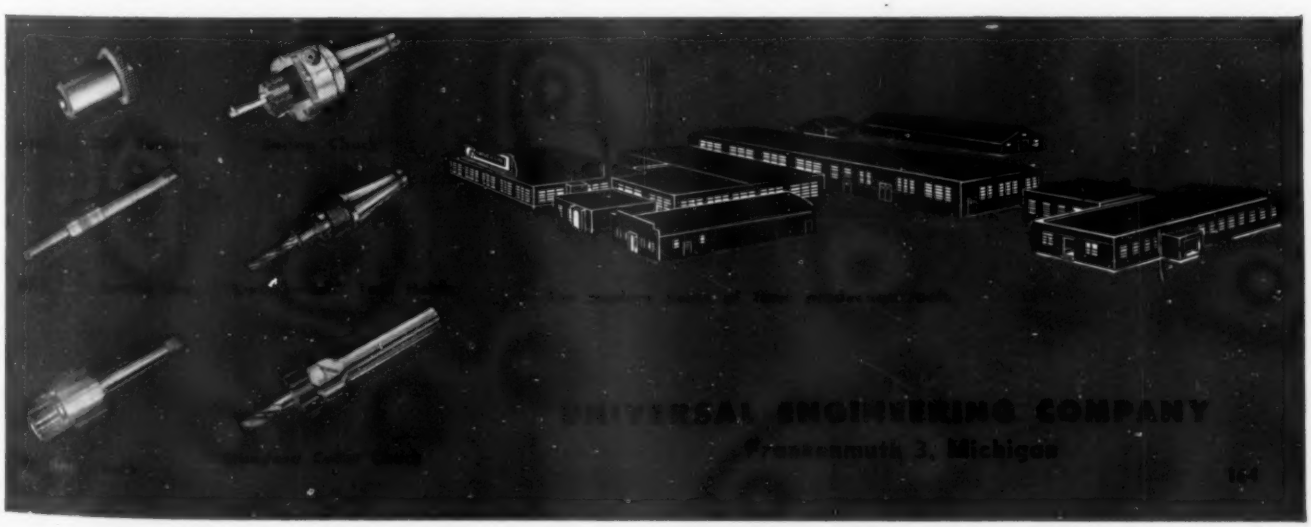
COMPLETE VARIETY OF

SIZES AND LENGTHS IN

UNIVERSAL SUPER FINISHED

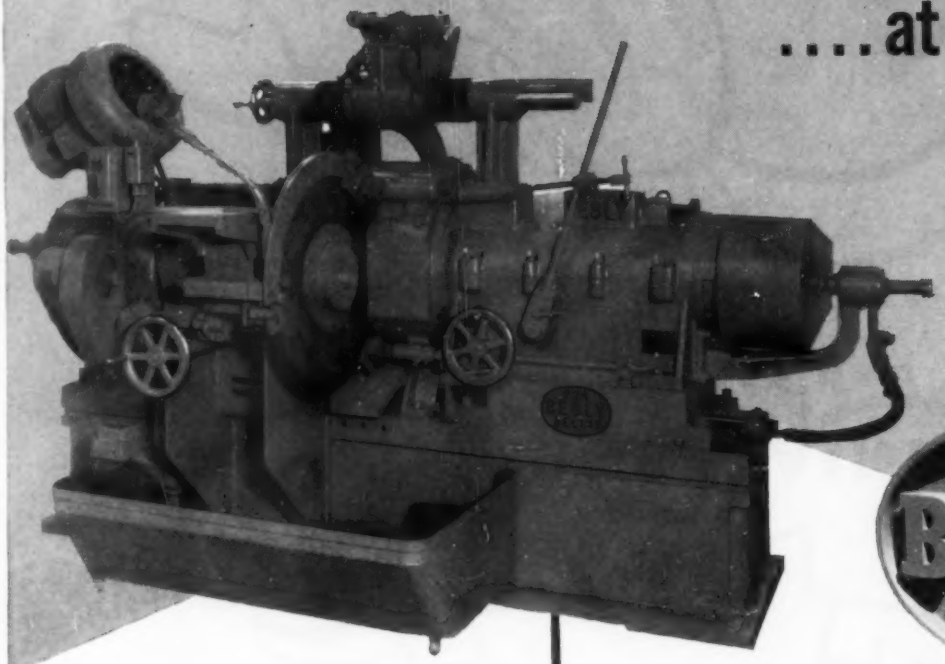
DRILL BUSHINGS

Check these features that make Universal drill bushings outstanding: 1. Super finish reduces wear to a minimum. 2. Blended radius reduces tool hang up. 3. 100% concentricity and hardness tests assure accuracy. 4. Knurled head provides quick sure grip. Order from the office nearest you ... 1060 Broad St., Newark, N.J., 5035 Sixth Ave., Kenosha, Wis., or write direct to our home office.



ACCURACY HELD Within .0002"

for ① SIZE ② FLATNESS ③ PARALLELISM



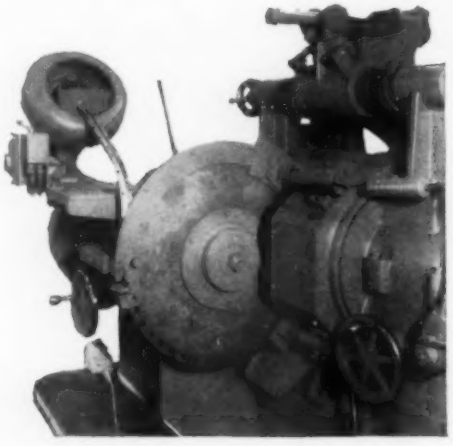
....at 750 Pieces Per Hour

with this

BESLY

AUTOMATIC FEEDING Gives Precision at Production Rates

Hydraulic pump vanes are automatically hopper fed into a constantly rotating feed wheel, which has a series of openings to receive parts. As the feed wheel revolves, the pump vanes are carried between the parallel faces of the abrasive discs where two sides of the vanes are simultaneously ground. After grinding, the parts are automatically unloaded into a discharge pan.



No. 226 Double Spindle Wet Disc GRINDER

High speed steel pump vanes which are used in the hydraulic pump of an automotive power steering unit are finish ground with this precision grinder . . . and at a rate of 750 pieces or 1500 surfaces an hour. Precision at production rates can be yours, too, because Besly Double Spindle Wet Disc Grinders can be easily adapted to grind many other parallel surfaced parts. Write for full information.

BESLY

BESLY-WELLES
CORPORATION

Established as Charles H. Besly & Company in 1875
118 Dearborn Ave., Beloit, Wisconsin

BESLY GRINDERS AND ACCESSORIES • BESLY TAPS, DRILLS, REAMERS • BESLY-TITAN ABRASIVE WHEELS

DIXI 60

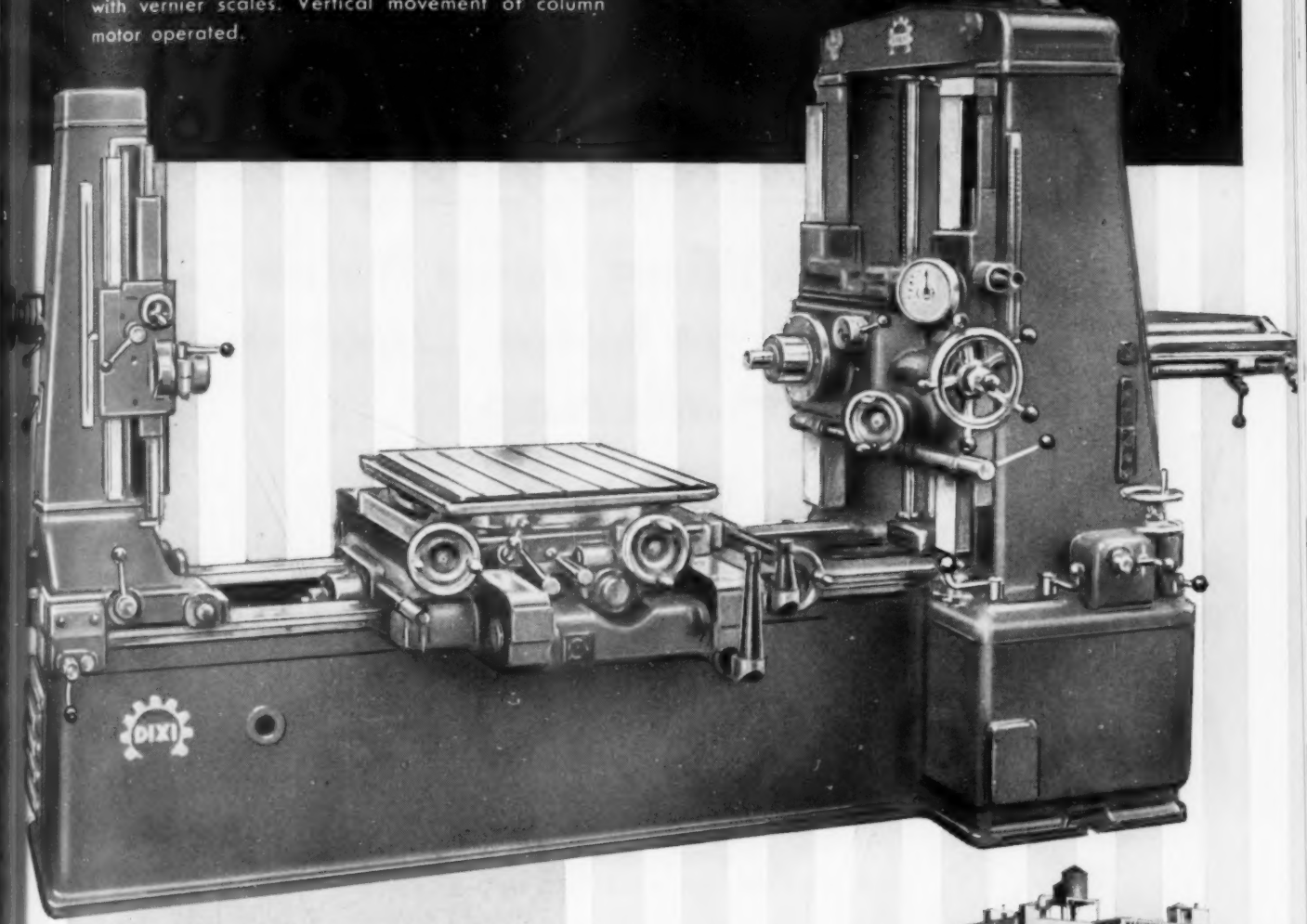
COMBINATION HORIZONTAL BORING MILL AND JIG BORER WITH OPTICAL MICROSCOPES

OUTSTANDING FEATURES:
A precision machine for drilling, boring, recessing, and milling work. Table can be rotated to 360 degrees. Accurate automatic locking of rotary table every 15 degrees, and at any other position by hand. Table and spindlehead have variable hydraulic feed. All coordinate dimensions can be set by dials, and adjustment made through optical microscopes. Mechanical spindle feed can be changed without stopping machine. Automatic stop of spindle feed. Optical measuring system operates in conjunction with vernier scales. Vertical movement of column motor operated.

DEALERSHIPS AVAILABLE

Over 20 years experience in designing and building machinery

ALSO EXCLUSIVE UNITED STATES DISTRIBUTORS OF **LOW COST MULTI PURPOSE VISES • TAPPING ATTACHMENTS • QUICK CHANGE CHUCKS AND COLLETS • WILLE-GRIP KEYLESS DRILLCHUCKS MILLING MACHINE ARBORS, ADAPTERS, ARBOR SPACES AND BEARINGS • LATHE MANDRELS**



Headstock, column, and table settings by optical microscopes to insure overall accuracy of .0002". Built in rotary table with optical microscope. Tables size 28¾" x 32⅝". Max. distance table to spindle 19.7". Table travel, 23⅝". Hydraulic feeds for all functions 0-78" per min. #40 Taper spindle. Spindle travel 24.4". Spindle speeds 32-1350 R.P.M. Feeds .0015"-.010" per rev.

- Guaranteed Service by Trained Staff
- Engineering Staff will make recommendations based on your requirements
- Spare Parts in Stock
- Your Operators Trained
- Early Deliveries—Some from Stock
- Competitive Prices
- Financing and Rental Plans to Meet Your Requirements

Many More Machines For Every Operation

Write for free illustrated brochure 103, or state your specific requirements.

Our headquarters in New York City

Exclusive Representatives in the United States

M. B. I. EXPORT & IMPORT LTD.

475 GRAND CONCOURSE, BRONX 51, NEW YORK

MBI

CABLE ADDRESS: MACHBUILD, NEW YORK

Many More Machines For Every Operation

Write for free illustrated brochure 103,
or state your specific requirements.

CABLE ADDRESS: MACHBUILD, NEW YORK

the one source

for "Desegatized"® cold work die steels

COBALT CHROME

SELECT B

OLYMPIC

GSN

BR-4

Latrobe is the one source for these "DESEGATIZED" cold work die steels—each of them uniform in structure, non-deforming and abrasion resistant.

Cobalt Chrome . . . for long-run dies, possesses superior abrasion resistance, holds a super keen cutting edge.
Select B . . . a 5% chromium air hardening die steel, easily machined, long wearing, has maximum toughness.
Olympic . . . a die steel perfectly balanced for toughness, wear resistance and machinability, popular for intricate cold work applications.
GSN . . . the oil-hardening steel in this group, combines high hardness and compressive strength with excellent wear.
BR-4 . . . a "bear for wear"—this patented super abrasion resistant die steel provides the ultimate in wear resistance.

The cost of the finished dies you make or use is far too great for you to gamble with expensive failure during or after fabrication because of inferior raw materials. Avoid this risk—specify "DESEGATIZED" die steels for your next cold work dies.

Sole Producers of "DESEGATIZED" Steels

LATROBE STEEL COMPANY

Latrobe, Pennsylvania

Sales offices and warehouses:

BOSTON BUFFALO CHICAGO CLEVELAND DAYTON DETROIT HARTFORD LATROBE (Mill) LOS ANGELES MILWAUKEE NEW YORK PITTSBURGH PHILADELPHIA ST. LOUIS TOLEDO

Foreign offices in:

BRUSSELS PARIS GENEVA MILAN ROTTERDAM

The Story of

"The Crow and the Pitcher"

MAKES A POINT FOR GRINDING FLUID USERS...

The Story (one of Aesop's Fables)

A long, long time ago, a terribly thirsty crow had searched miles for water before he found an old pitcher with water in it. But the water was so low he couldn't reach it. His *obvious thought* was to push the pitcher over, but just in time he realized he'd lose the water that way. So he searched until he found some pebbles and, one by one, dropped them in the pitcher until the water level rose to where he could reach it.

The Point

The *obvious thought* about grinding fluids is not always the best. When selecting a grinding fluid for a precision grinding job, some plants think first of "just a coolant"—yet, many times, "more than a coolant is needed". A case to prove the point is shown at right. A low cost soluble oil was obviously not the answer to this straight grinding oil job! True, the initial cost of the grinding oil is more than that of the water-mixture, but the benefits offset the initial cost many times over.

If you grind valves, pistons, tappets, jet engine buckets or other aircraft parts, cutting tools, gears, or other parts where higher surface finish, less heat checks, or longer wheel life are desirable, just a little extra thought before you "tip the pitcher over" may pay great dividends. Investigate Stuart's Precision Grinding Oils. Fill in and mail the coupon below.

Comparison
Soluble Oil vs. Grinding Oil
on Valve Grinding Operation

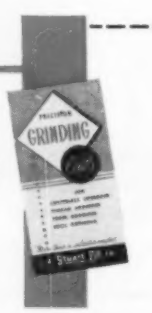
	OLD METHOD		NEW METHOD	
Grinding Fluid	Soluble Oil		SuperKool 81X Grinding Oil	
Material and Hardness	Steel Forgings Rc 30-36		Steel Forgings Rc 30-36	
Stock Removal	VALVE STEM Finish Grind .004"-.006" in 2 passes	VALVE FACE Rough Gr. .006"-.008" Finish Gr. .004"-.006" in 2 passes	VALVE STEM Finish Grind .004"-.006" in 1 pass	VALVE FACE Rough & Finish Grind in 1 pass .014"
Average Production per Wheel Dressing	350-400 pcs.	300-350 pcs.	2000 pcs.	1200 pcs.
Total Life of Wheels	Maximum of One Week		Eight Weeks	

More Than a "Coolant" is Needed

D. A. Stuart Oil Co.
EST 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

2727-49 S. Troy St., Chicago 23, Ill.



JUST CLIP TO YOUR LETTERHEAD AND MA
D. A. Stuart Oil Co., Ltd., 2727-49 S. Troy St., Chicago 23, Illinois

☐ Have your representative call.
☐ Send booklet on Precision Grinding Oils.

Name.....

Title.....

BOYAR-SCHULTZ

A proven necessity

Foreign offices in:
BRUSSELS PARIS GENEVA MILAN ROTTERDAM

CLEEREMAN JIG BORERS

Precision—

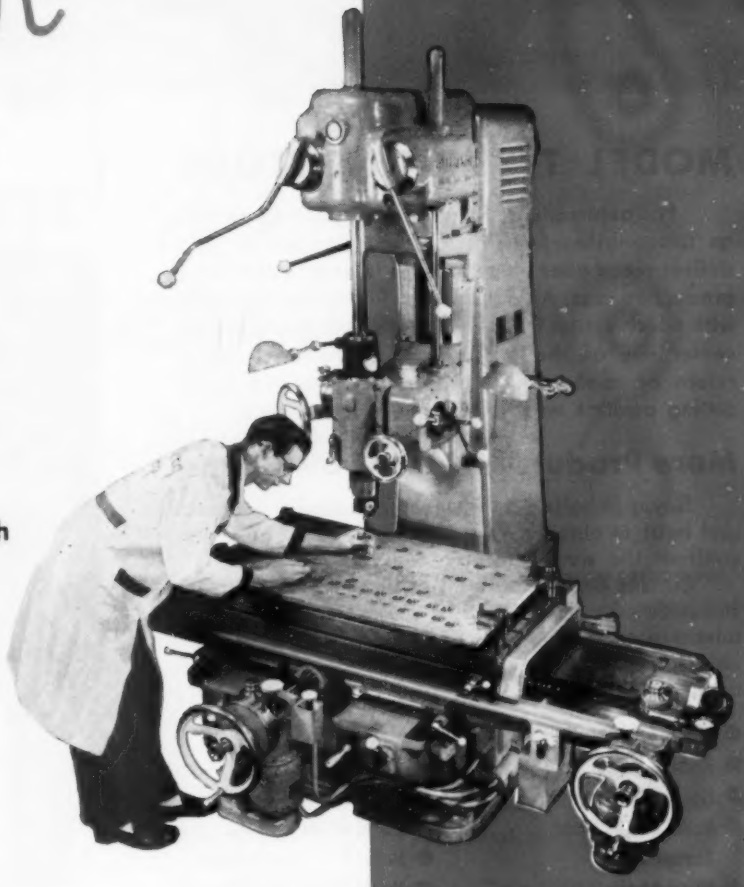
by

CLEEREMAN

. . . for ultra-fine tolerances on highest quality gage, tool, die, jig and fixture work—and on "jigless" production

. . . to stand the gaff in today's high pressure tool room and production plant service

. . . for higher profits and higher output through the ultimate in operating ease and efficiency



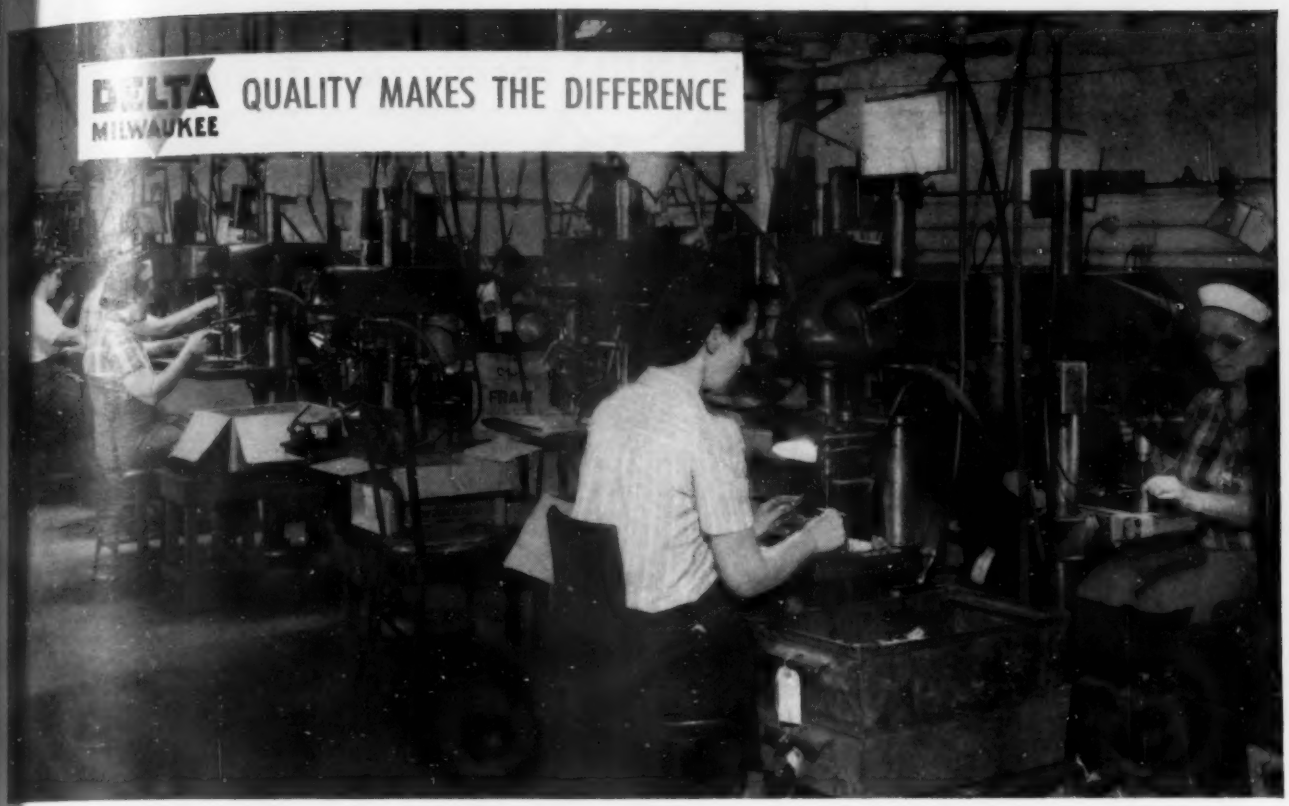
BRYANT
Machinery & Engineering
• Company •
General Office
640 West Washington Blvd., Chicago 6
Representatives in Principal Cities

AFFILIATED WITH

CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 133.



18 Delta drill presses work interchangeably on several materials. Additional machines, set up ready for use, can be moved in and out of the line. Simple fixtures and Delta accuracy make jobs practically fool proof on machines that almost "run themselves."

Down Go Costs

WHEN ASTATIC CORP. PUTS **DELTA TOOLS** ON JOB

These Production Ideas Will Work for You, Too !

Here's how the Astatic Corp., Conneaut, O., manufacturer of microphones, radio, phonograph and television parts, gets high production and high precision at low cost with a shop full of Delta tools—drill presses, grinders, metal cutting bandsaws, and abrasive finishing machines.

FLEXIBILITY—

Because Delta tools are light and mobile, Astatic takes them to the material, cutting handling costs; moves them, already set up, in and out of the production line as jobs change. Five different materials from steel to plastics are machined on the same Delta tools.

INTERCHANGEABILITY—

By standardizing on Delta, Astatic uses the same jigs and fixtures on several machines without adjusters.

FEWER SET-UPS—

By keeping machines set up for special jobs, one operator can tend several machines and do sequence operations. No waste motion. Because Delta tools are a low capital investment, they don't have to run constantly to pay out.

QUALITY—

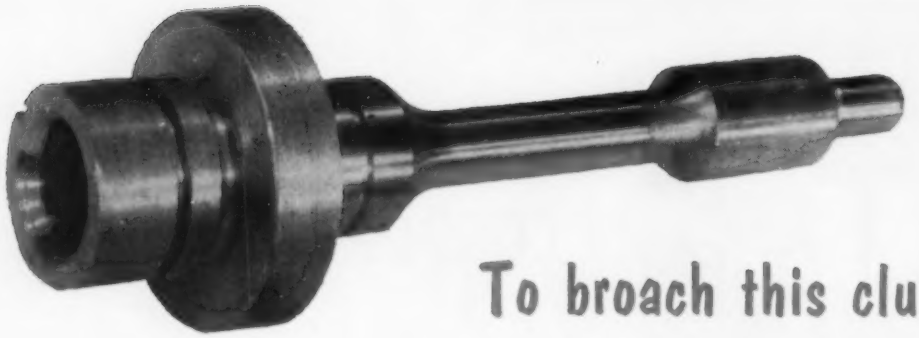
Most of the Delta tools at Astatic have been on the job six to nine years with only routine maintenance—proving that Delta gives you machine tool quality at a cost any production operation in your plant will justify.

Do you have an up-to-date catalog of Delta tools? Call your Delta dealer. He's listed in your Classified Phone Book under "Tools", or write for Catalog AB, Delta Power Tool Division, Rockwell Manufacturing Company, 620H N. Lexington Ave., Pittsburgh 8, Pa.

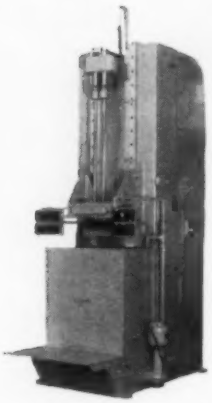
DELTA QUALITY POWER TOOLS

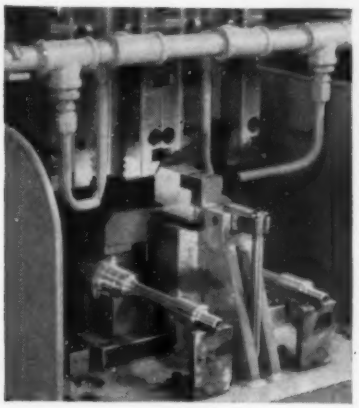
Another Product by **Rockwell**

New Thompson AUTOMATIC double wheel TRUFORM Grinder speeds jet engine production



To broach this clutch gear...





use this *American* machine... in this fashion...

...to get this result!

Approximately 300 clutch gears per hour can be broached on this American 3-Way Type Vertical Hydraulic Broaching Machine. A two station fixture is provided to locate parts in V-shape locators. Air clamping locks the parts into place. At the end of the broaching stroke the parts are automatically unclamped and the operator unloads them while returning the machine ram to starting position.

Flats approximately 5/16" wide are broached on the diameter of the large end of the gear.

This broaching operation is a standard operation on a standard American machine. If your problem is more difficult, American has the experience and skill to devise a special machine, fixture or broach for your purposes. Send a part-print or sample for a recommendation leading to a solution of your broaching problem. Or send for catalog #300 which illustrates and describes standard American machines.

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

Lindberg Engineering Company, 2450 West Hubbard Street, Chicago 12, Illinois

New Thompson AUTOMATIC double wheel TRUFORM Grinder speeds jet engine production

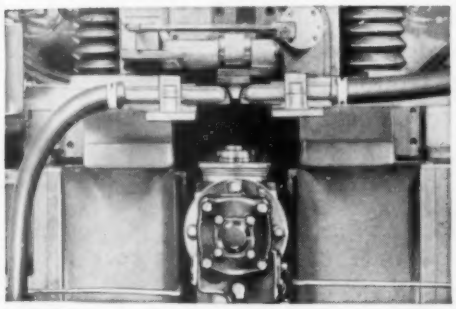
GRINDS BOTH SIDES OF JET TURBINE BUCKETS OR BLADES SIMULTANEOUSLY IN A SINGLE SETTING

To grind root sections on gas turbine buckets with greatest accuracy and productivity, Thompson developed this new AUTOMATIC double wheel TRUFORMING machine featuring simultaneous grinding of both sides of root section with one setting of work.

Grinds rough to finish in 110 seconds . . . or 30 buckets per hour

Hood doors, work clamps, coolant flow, grinding and crushing cycles are actuated in automatic sequence on the new Thompson AUTOMATIC double wheel TRUFORM Grinder.

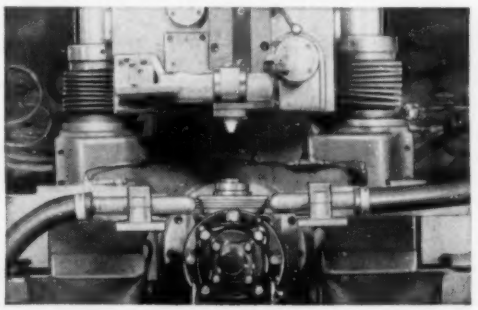
On a bucket having 2″ length of form similar in design to the one in the diagram above with .150″ stock removal per side from rough to finish size, production is 30 buckets per hour at a steady day after day rate. This includes down time for dressing, regrinding the crusher roll, initial machine warm up period, wheel changing and diamond changing. Actual machine time from rough forging or casting to finish is 104 seconds plus 6 seconds for loading and unloading time . . . makes total time floor to floor 110 seconds per piece.



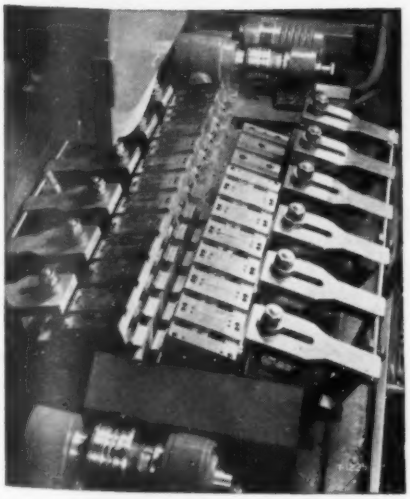
FOR ABSOLUTE SYMMETRY BOTH WHEELS ARE DRESSED FROM A SINGLE CRUSHER ROLL

GRINDING POSITION

CRUSHING POSITION

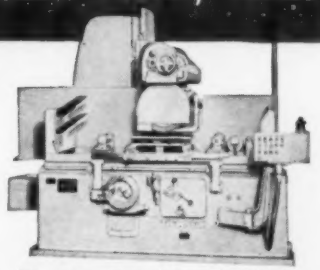


Standard THOMPSON TRUFORM Machines also grind jet buckets faster, better



By means of multiple grinding of jet turbine buckets the standard TRUFORM Grinders still offer high production plus many advantages such as flexibility of standard machine design and lower first cost. Although compared to the new AUTOMATIC the standard TRUFORM requires more skillful set up and tooling.

Typical tooling on Type "C" TRUFORM producing 24 buckets per hour. Type "B" TRUFORM produces 18 parts per hour.



Thompson Type "C" TRUFORM

FOR COMPLETE DETAILS WRITE TODAY

The Thompson Grinder Co.
Springfield, Ohio

Thompson SURFACE Grinders

Now... Longer Gage Life

...WITH TAFT-PEIRCE *Electrolized* GAGES

Experience proves that these electrolized Taft-Peirce Gages give many times longer life than ordinary hardened steel gages.

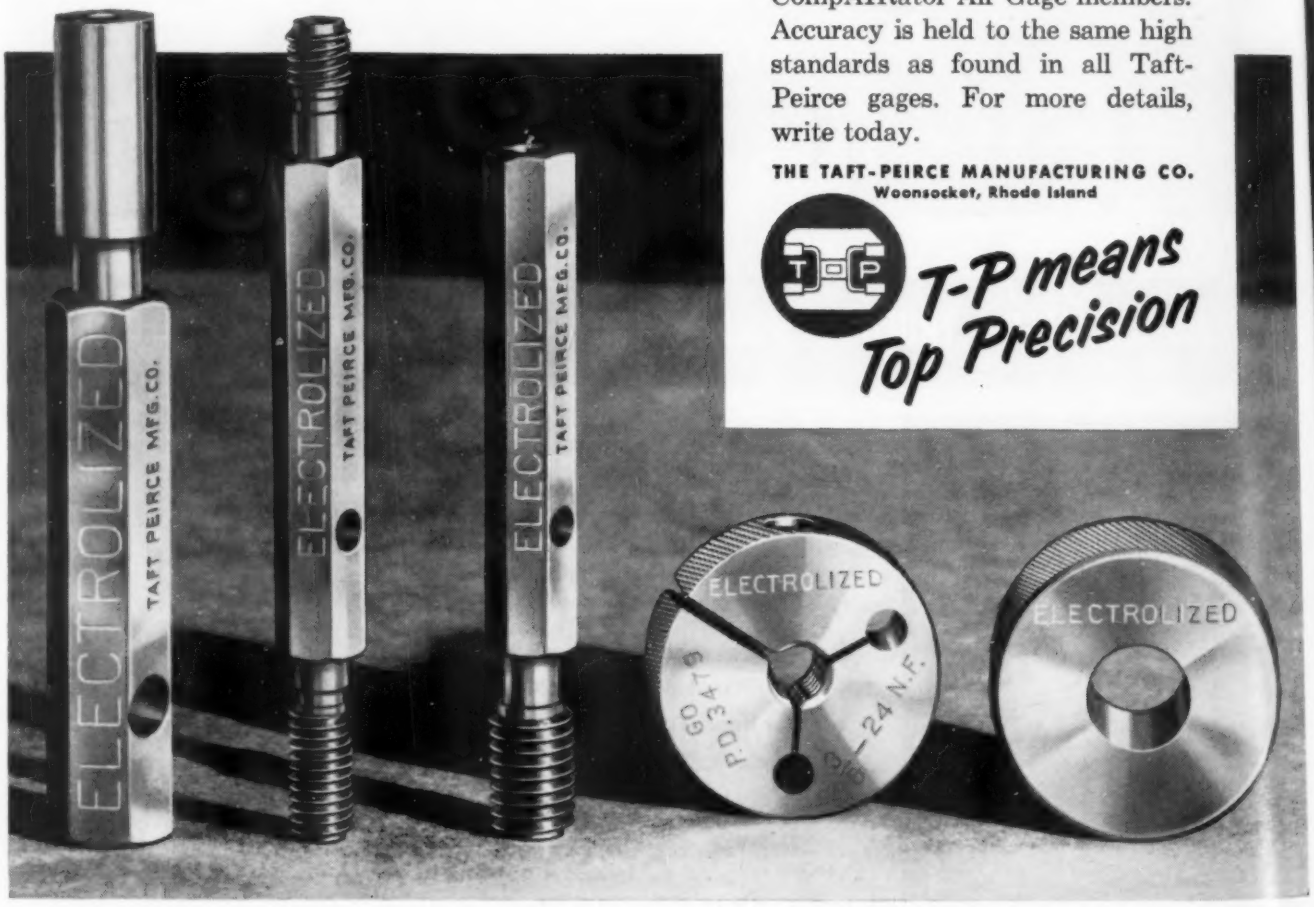
An even film of hard, non-magnetic alloy — only .000025″ thick — on all gaging surfaces provides exceptional wear-resistance.

Extremely smooth, this film has a very low co-efficient of friction, with high resistance to corrosion. Extremely tough, it won't chip, peel, or spall.

Electrolizing can be applied to standard or special gages and to CompAIRator Air Gage members. Accuracy is held to the same high standards as found in all Taft-Peirce gages. For more details, write today.

THE TAFT-PEIRCE MANUFACTURING CO.
Woonsocket, Rhode Island

T-P means Top Precision



and in any location

REX HIGH SPEED STEEL *is always the same, too*

Crucible's REX High Speed Steels are the same no matter where or in what form you buy them. That's because their quality is thoroughly checked through every phase of manufacture... from melting to the last finishing operation. This persistent attention to quality assures you that all REX High Speed Steels are uniform.

And it's readily available. All Crucible warehouses, which are conviently located throughout the country, are well stocked with REX AA, REX M2 and other grades of this quality brand. Next time you need high speed steels, call Crucible.

WRITE TODAY for the unique Crucible Tool Steel Selector, 9" diameter, in 3 colors — a twist of the dial tells you which tool steel is best for your application. Address your request to Crucible Steel Company of America, Dept. T, Oliver Building, Pittsburgh 22, Pa.

Rex® High Speed Steels
Peerless Hot Work Steels
Halcomb 218
Chro-Mow®
Sanderson Carbon Tool Steels
Ketos®
AirKool Die Steel
Airdi® 150
Nu-Die V Die Casting Steel
CSM 2 Mold Steel
La Belle® Silicon #2
Atha Pneu

SPECIFY
YOUR TOOL STEELS
BY
THESE
BRAND NAMES

CRUCIBLE first name in special purpose steels

53 years of Fine steelmaking

TOOL STEELS

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 133.

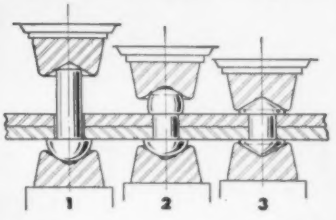
QUIET *riveters at work*

. . . not a sound as rivets are cold formed in 2½ seconds . . . each the exact counterpart of its neighbor. . . because Hannifin "Hy-Power" Riveters are at work.

These modern production tools, widely used in the highly competitive automotive industry to reduce costs and improve production, greatly simplify and speed up riveting. What's more, by riveting cold with this "silent squeeze" method, operators get a better, stronger riveted joint, every time. Hannifin "Hy-Power" portable and stationary yoke riveters are available in capacities from 7½ tons to 100 tons (more in multiple). Powered by the exclusive, patented "Hy-Power Hydraulic Generator, their quiet, automatic cycle is started with a touch of a button—yet, for safety, the stroke can be interrupted and the ram reversed at any point in the cycle, simply by releasing the control button.

If you rivet, stake, punch, press or bend, there's a place in your production picture for Hannifin "Hy-Power" equipment. Hannifin Field Engineers are located in leading industrial centers to advise you. Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Illinois.

The quiet "Hy-Power" Hydraulic Work Cycle



Hydraulic pressure, under instant, reversible, finger-tip control, silently squeezes rivets in this manner:

1. Fast approach (completed)
2. Rivet being squeezed
3. Rivet formed; ram returns

WRITE FOR BULLETIN 150

This bulletin tells the complete story of how Hannifin "Hy-Power" Hydraulic equipment can help you. Write today . . . a copy will be on its way tomorrow.

do ALL you can do . . . with

HANNIFIN

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-8-225

40 YEARS

OF LEADERSHIP

Management and employes take pride in announcing to our many friends and customers that Eclipse Counterbore Company became 40 years of age in May. From a humble beginning in 1913 to a position of leadership in 1953, Eclipse is today truly synonymous with quality in the cutting tool industry. This healthy maturity could never have been attained without the help of those same friends and customers . . . and so to them we say "Sincere Thanks."

The orginal Eclipse interchangeable single-diameter counterbore created in 1913.

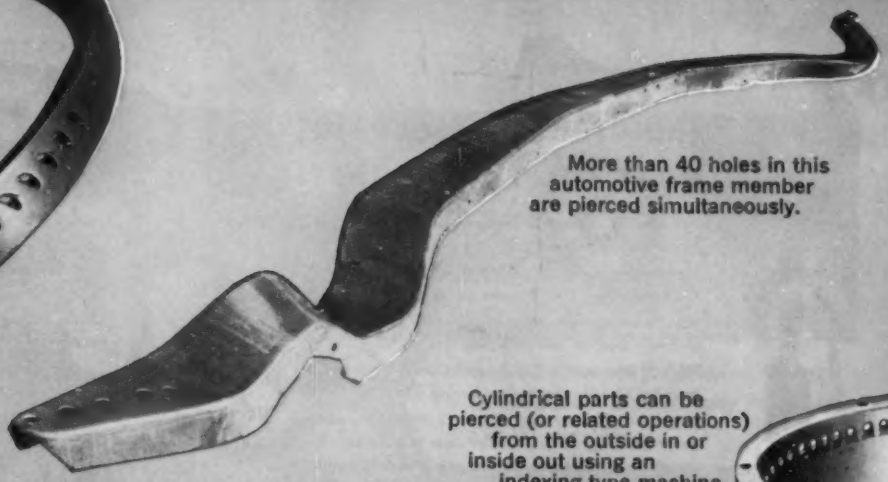
A modern multi-diameter carbide tipped Eclipse Cutter.

ECLIPSE COUNTERBORE CO.

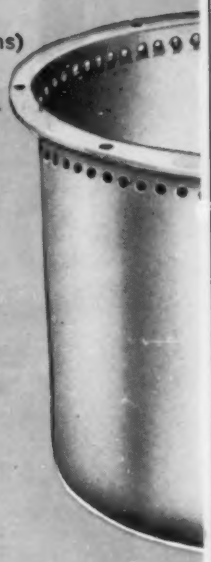
Founded in 1913

DETROIT 20, MICHIGAN

Irregularly shaped holes are pierced in this stainless steel jet engine part to very close tolerances—automatically.



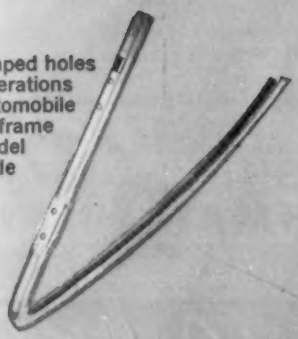
More than 40 holes in this automotive frame member are pierced simultaneously.



Cylindrical parts can be pierced (or related operations) from the outside in or inside out using an indexing type machine.

High Production Piercing...

IN A SINGLE SET-UP



...en irregular shaped holes ...two trimming operations ...omplete this automobile ...r inner window frame ...h one setup. Model ...nges can be made ...little expense.

Based on a recent development in piercing technique, you can pierce more holes simultaneously—faster and with greater accuracy—on Danly Metalworking Equipment. Eliminate awkward multiple handling . . . pierce all holes faster in a simple, single set-up.

Built specifically for your piece part, these are only a few of the advantages of Danly Hydraulic Metalworking Equipment:

...REE

...rite for this ...lletin today!

Consider these important features!

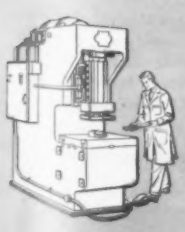
- *HIGH CAPACITY*—Up to 225 tons available per cylinder.
- *BREAKTHROUGH SHOCK PRACTICALLY ELIMINATED*—Permits greater capacity without hydraulic circuit or tool trouble . . . smoother, faster.
- *AUTOMATIC STRIPPING*—An integral feature of every cylinder . . . each station hydraulically strips its punch. This unique action simplifies fixturing, is practically foolproof.
- *ACCURACY, FLEXIBILITY*—Pierces practically any type of hole . . . round, oblong or irregular to very close tolerances.

DANLY®

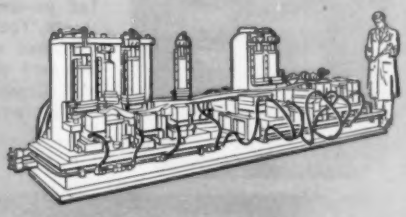
DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue • Chicago 50, Illinois

HYDRAULIC METALWORKING EQUIPMENT
MECHANICAL PRESSES . . . 50 TO 3000 TONS

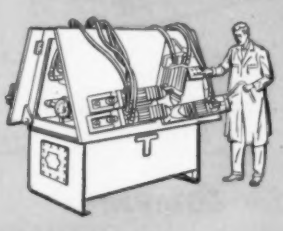
DANLY HYDRAULIC METALWORKING EQUIPMENT



General Purpose Gap Frame Piercing Press

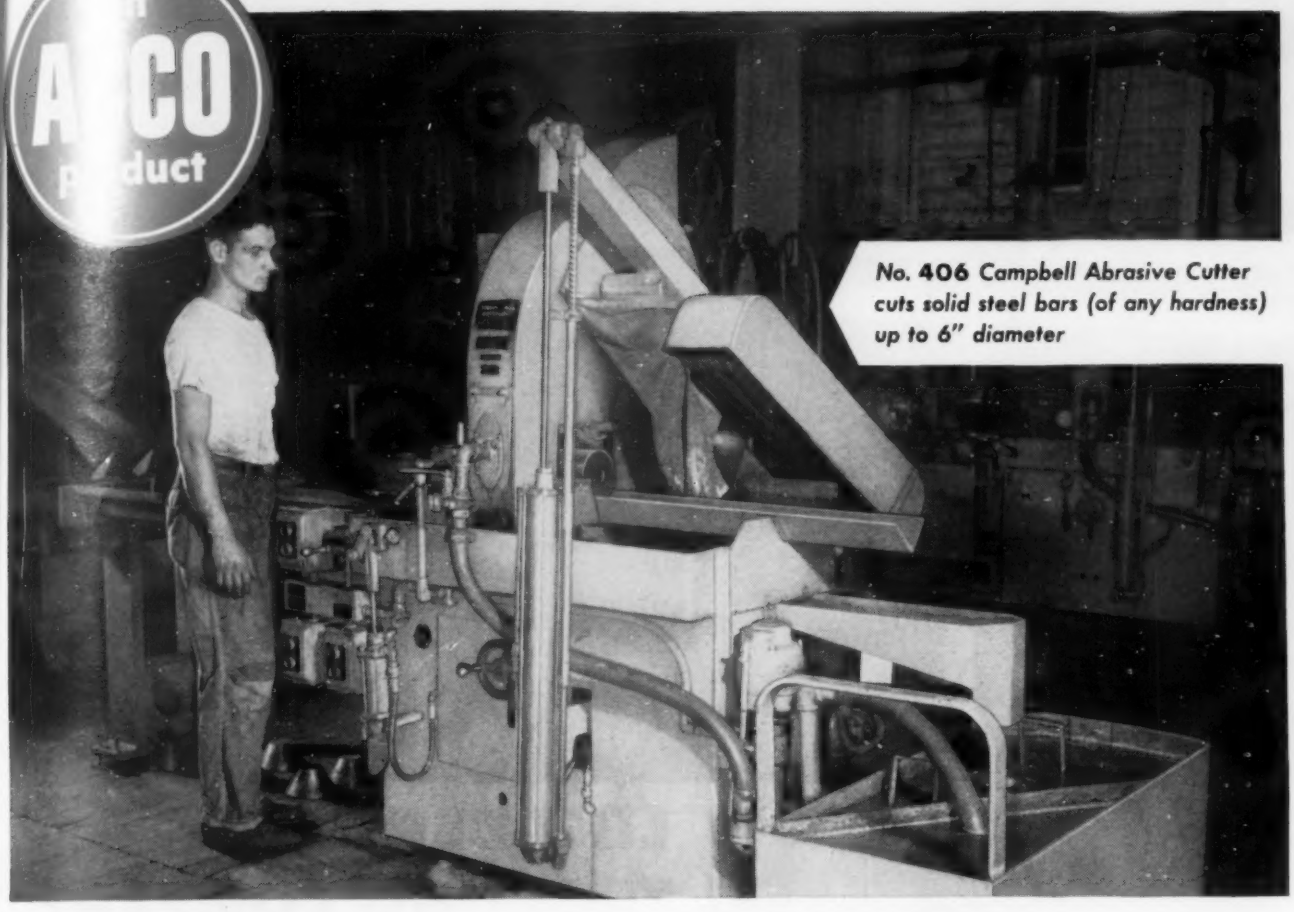


Automotive Frame Piercing Machine



Automotive Inner Window Frame Piercing Machine

Jet Engine Shroud Ring Piercing Machine



No. 406 Campbell Abrasive Cutter cuts solid steel bars (of any hardness) up to 6" diameter

CAMPBELL Abrasive Cutting Method Sets New Cut-Off Standards

• Recently CAMPBELL was called upon to cut samples of 8" x 8" No. 8740 Chrome Molybdenum steel each taking 210 minutes the old-fashioned way. The buyer was skeptical of the burn-free, smooth, close-tolerance cuts that took only 18 minutes each on the CAMPBELL NO. 480 which takes work up to 8" square. He insisted on seeing the CAMPBELL Cutter in operation cutting his own steel, which he did at a plant of one of our customers. He was convinced and placed his order for a CAMPBELL 480.

• • •

Perhaps you have cutting problems that can be solved with the speed, accuracy and quality of cuts you can get on a CAMPBELL Abrasive Cutter. If so, let us prove what this remarkable machine will do on your own material. Let us show you before your own eyes.

No matter what hardness or shape of metal you must cut repeatedly, if it will fit on one of many sizes of CAMPBELL Abrasive Cutters, which have a range up to 8" diameter solids and 20" diameter tubular, we'll show you how to cut it faster and better. Write today for "*Principles of Abrasive Cutting.*" Give us the material specifications and we'll be glad to make recommendations.

ACCO

TRADE MARK

CAMPBELL MACHINE DIVISION
AMERICAN CHAIN & CABLE

945 Connecticut Ave., Bridgeport 2, Conn.

CAMPBELL
Abrasive Cutters and Nibblers

HOW LINDBERG STEEL TREATING COMPANY HELPS MOW YOUR LAWN

Plants in

MELROSE PARK, ILL.
(Chicago)
1977 North Ruby
MOnroe 6-3308

ROCHESTER, N. Y.
620 Buffalo Rd.
GEnessee 5212

ST. LOUIS
650 E. Taylor
FIreside 6200

LOS ANGELES
2910 So. Sunol Drive
ANgelus 9-7311

Gus Stuart next door . . Tom Dougherty down the street . . and Harry Van Hook in the next town are taking it easy.

For these lazy, lucky critters live in the era of the power lawn mower . . they just give it the gun, and zoom . . a beer-and-a-half later the yard is mowed, slick as a whistle.

We're not about to tell you Lindberg Steel Treating Company is solely responsible for the power lawn mower industry. That isn't exactly the case. But, along with dozens of designers, engineers, and production men, we kicked in our two cents worth.

Quite a few power lawn mowers have cast aluminum shells . . one of them is the "Lawn-Boy" made by *Outboard Marine & Manufacturing Company**. "*Outboard*" needed mold dies to produce these mower shells . . and the dies had to be heat treated. They were intricate, had plenty of irregular sections, and they were worth $15,000.

The highly polished surface finish had to be maintained. Critical dimensions had to be held. There could be no carb or decarb, because surface cracking or "orange peeling" would result. Brinnel hardness had to be held to a narrow range. And there could be no variation in hardness uniformity.

So the job was turned over to heat treating specialists . . metallurgical engineers of Lindberg Steel Treating Company. They determined the proper cycle for preheating, soaking, cooling, and tempering.

91 short hours after delivery to Lindberg, the dies were ready to produce aluminum mower shells. Heat treating is easy . . *if* you do the *right* thing, at the *right* time, in the *right* equipment, in the *right* way. We specialize in doing heat treating . . *right*. Call us.

* *RPM Manufacturing Company Division*

A case history of Lindberg Steel Treating Co. service to American industry

LINDBERG STEEL TREATING CO.
1977 North Ruby Street, Melrose Park (Chicago), Illinois Phone: MOnroe 6-3308

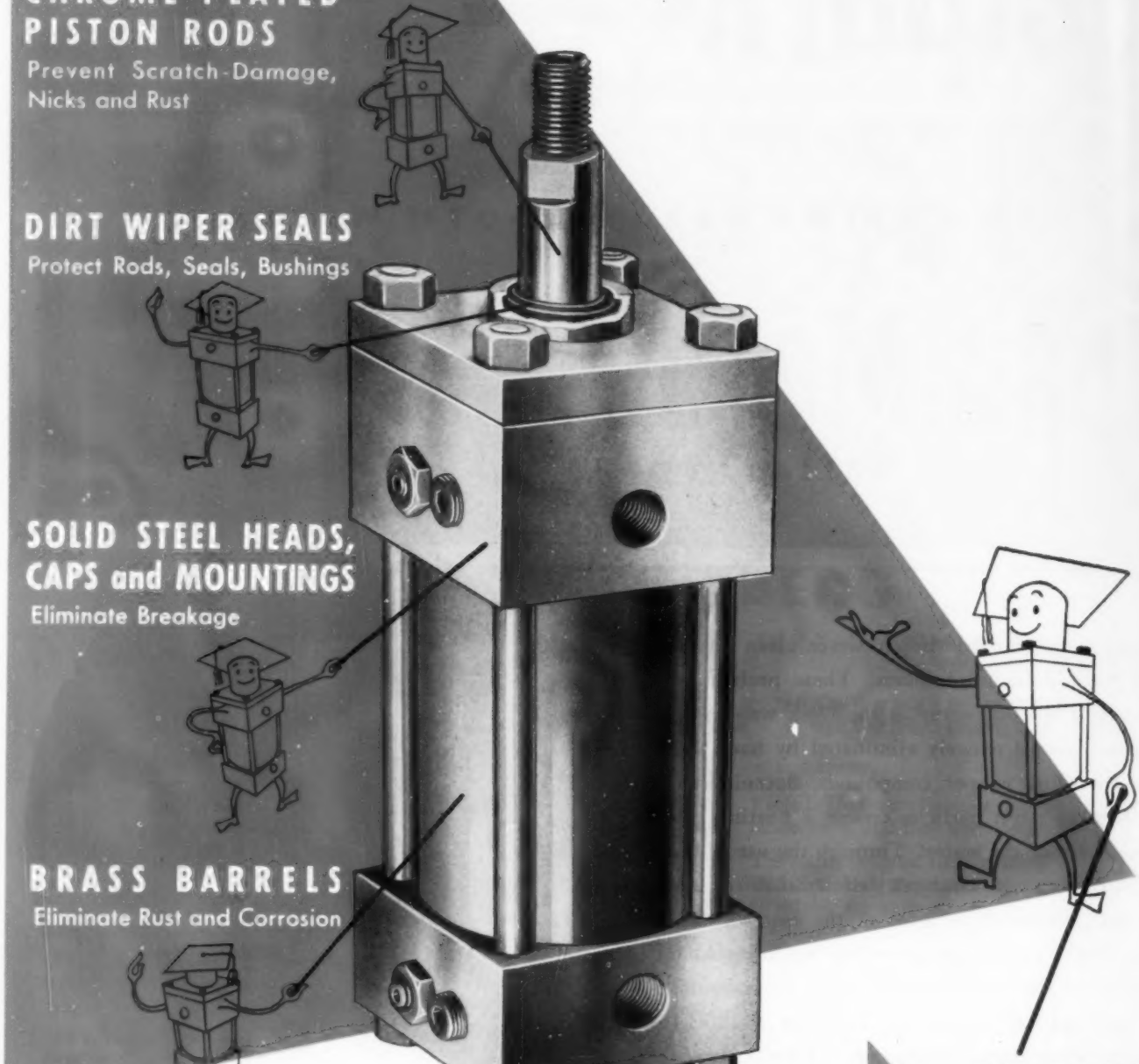
Miller AIR CYLINDER

HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

DIRT WIPER SEALS
Protect Rods, Seals, Bushings

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage

BRASS BARRELS
Eliminate Rust and Corrosion



WRITE FOR CYLINDER BULLETINS A-105 and H-104

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

MET J. I. C. PNEUMA STANDARDS years be their adoption in 1950.

SPACE-SAVING SQU DESIGN originated by in 1945.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

Miller

MILLER MOTOR C MPA

2010 N. HAWTHORNE AVE., MELROSE PAR

AIR & HYDRAULIC CYLINDERS • BOOSTERS ACCU
COUNTERBALANCE CYLINDE

City_____ State_____

WHY generate when you can convert?

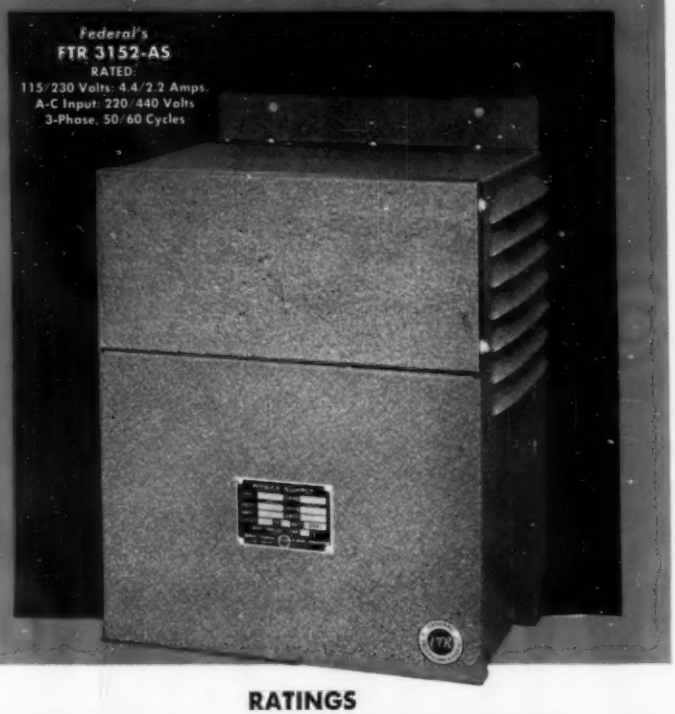
GET DC DIRECTLY FROM AC

Cut costs, maintenance and replacements with

Federal

SELENIUM RECTIFIER EQUIPMENTS

famous for steady, long-life industrial power supply



NO costly, bulky, moving equipment to buy . . . no expendable parts to replace frequently . . . virtually no maintenance!

No wonder Federal's compact, silent, rugged, ever-dependable selenium rectifiers are the economical and efficient way to get DC . . . for chucks, brakes, clutches, drums, pulleys, relays, circuit-breakers, motors and many other applications . . . for all DC needs of the machine tool industry.

Federal Equipments are ready to connect to your AC source . . . ready to deliver uninterrupted service. Powered by Federal's completely inert selenium rectifiers, their life is practically unlimited. All are conservatively rated . . . with a wide margin of safety to withstand momentary heavy overloads.

If the DC output you need is not listed in the table, Federal will gladly design and build to meet any specific requirements. Fill out and mail the attached coupon today!

RATINGS

CODE NUMBER	A-C INPUT			D-C OUTPUT	
	VOLTS	PHASE	CYCLES	VOLTS	AMPS.
FTR 3115-JS	115	1	50/60	115	1
FTR 3116-BS	115	1	50/60	115	5
FTR 3117-HS	115	1	50/60	115	10
FTR 3117-JS	230	1	50/60	115	10
FTR 3152-AS	220/440	3	50/60	115/230	4.4/2.2
FTR 3153-AS	220/440	3	50/60	115/230	6.6/3.3
FTR 3154-AS	220/440	3	50/60	115/230	8.8/4.4
FTR 3155-AS	220/440	3	50/60	115/230	13/6.5
FTR 3228-BS	220/440	3	50/60	115/230	26/13

MAIL COUPON TODAY for data on available FTR equipments, or any desired rating:

"America's first and largest manufacturer of selenium rectifiers"

Federal Telephone and Radio Corporation

SELENIUM-INTELIN DIVISION: 100 KINGSLAND ROAD, CLIFTON, N. J.

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N.Y.

Federal Telephone and Radio Corporation
Selenium-Intelin Division, Clifton, N. J. Dept. E-3145

☐ Send complete data on FTR code numbers indicated below:

☐ Send preliminary data on the following rating:

FTR..... .....

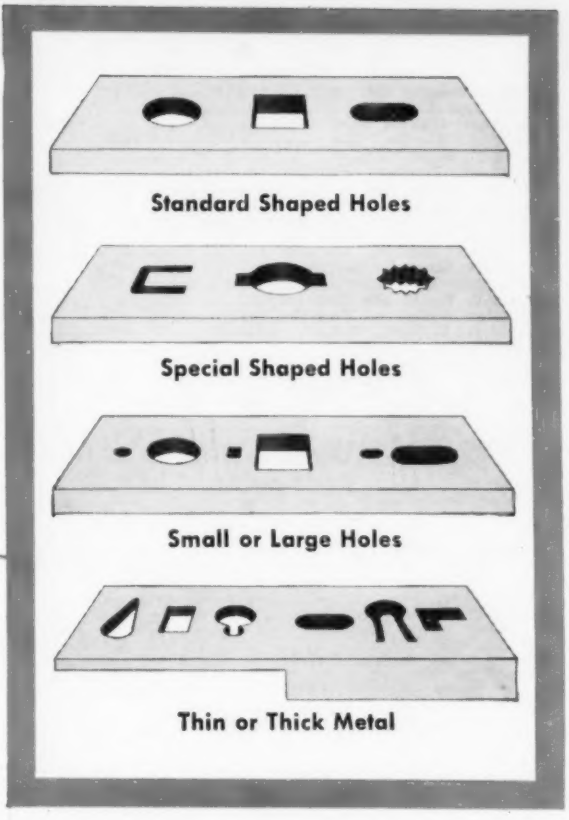
FTR..... .....

Company_____

Address_____

Signature_____

WHEN R-B Punches Are Used

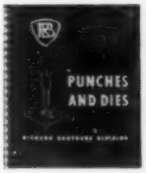


What are your piercing or forming requirements —standard or unusual shapes—small or large holes—steel or special alloys—thin or thick metals? There is either an R-B punch in standard shapes and sizes or R-B will manufacture special punches, die buttons and retainers to your specifications that will provide more efficient piercing operations.

Many hole-making applications, formerly requiring drilling or some other costly means, can now be done with R-B interchangeable punches. If you have thought your piercing jobs too tough for interchangeable punches, it will pay you to investigate the wide application potential of R-B standardized equipment.

R-B Engineering Service Is Available for Your Tough Piercing Problems.

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
Dept. 73 • 12667 Burt Rd. • Detroit 23, Michigan
Please send me additional information.



NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Also Produced in
OTHER ALLIED PLANTS
SPECIAL COLD FORGED PARTS
STANDARD CAP SCREWS
PRECISION GROUND PARTS
SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

Index of The Tool Engineer Advertisers

August 1953 Issue

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

♦User of ASTE Data Sheets

THE TOOL ENGINEER REGIONAL ADVERTISING OFFICES

EASTERN—Austin G. Cragg, 400 Madison Ave., Phone: Plaza 9-4018, New York 17, New York

OHIO—Richard E. Cleary, Commercial Bank Building, Phone: Berea 4-7719, Berea, Ohio

CENTRAL—Clarence T. Etter, 10700 Puritan Avenue, Phone: University 4-7300, Detroit 21, Michigan

WESTERN—Stanley F. Girard, 540 N. Michigan Avenue, Phone: Michigan 2-4465, Chicago 11, Illinois

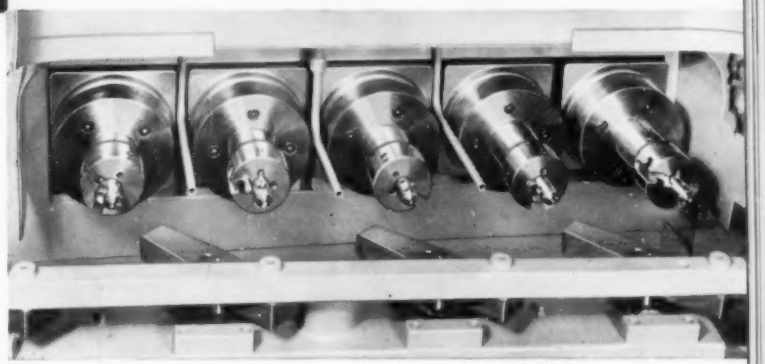
PACIFIC COAST—W. R. McIntyre, 423 First Trust Bldg., Phone: Ryan 1-6981, Pasadena 1, California
W. R. McIntyre & Associates, Room 1085, 681 Market Street, Phone: Douglas 2-4475, San Francisco, California

80 SURFACES IN 1 CYCLE

EX-CELL-O

MACHINE BORES, COUNTERBORES, FACES AND CHAMFERS 20 HOLES

This Ex-Cell-O Precision Boring Machine performs operations on 80 surfaces in one cycle on the projecting holes of a cotton picker bar assembly. Five spindles on the machine bridge are positioned to engage every fourth hole. The fixture indexes automatically between machining strokes to align the next set of holes with the boring bars.



The machine is a standard Style 112-C having a heavy well-ribbed base and table, long stroke; handles medium-sized and large work.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

Ex-Cell-O's line of standard Precision Boring Machines is exceptionally complete. Ask your local Ex-Cell-O representative about them, or write to Ex-Cell-O in Detroit for Catalog 31205.

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

DETROIT 32, MICHIGAN

XLO

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT